NAVSHIPS 92556

GCA-50

INSTRUCTION BOOK

for

R. F. SIGNAL GENERATOR SET AN/URM-25E

HARVEY-WELLS ELECTRONICS, INC.
SOUTHBRIDGE, MASSACHUSETTS

BUREAU OF SHIPS NAVY DEPARTMENT

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DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
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IN REPLY REFER TO
Code 993-100
22 July 1955

From: Chief, Bureau of Ships
To: All Activities Concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Instruction Book for Signal Generator AN/URM-25E, NAVSHIPS 92556

1. This is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

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A. G. MUMMA
Chief of Bureau

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

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GUARANTEE

The Contractor guarantees that at the time of delivery thereof the supplies provided for under this contract will be free from any defects in material or workmanship and will conform to the requirements of this contract. Notice of any such defect or non-conformance shall be be given by the Government to the Contractor within one year of the delivery of the defective or non-conforming item, unless a different period of Guarantee is specified in the Schedule. If required by the Government within a reasonable time after such notice, the contractor shall with all possible speed correct or replace the defective or non-conforming item or part thereof. When such correction or replacement requires transportation of the item or part thereof, shipping costs, not exceeding usual charges, from the delivery point to the Contractor's plant and return, shall be borne by the Contractor; the Government shall bear all other shipping costs. This Guarantee shall then continue as to corrected or replacing supplies or, if only parts of such supplies are corrected or replaced, to such corrected or replacing parts, until one year after the date of redelivery, unless a different period of Guarantee is specified in the Schedule. If the Government does not require correction or replacement of a defective or non-conforming item, the Contractor, if required by the Contracting Officer within a reasonable time after the notice of defect or non-conformance, shall repay such portion of the contract price of the item as is equitable in the circumstances.

INSTALLATION RECORD

Contract Number NObsr-63060 Date of Contract, 30 September 1952

Serial Number of Equipment .....

Date of acceptance by the Navy .....

Date of delivery to contract destination .....

Date of completion of installation .....

Date placed in service .....

Blank spaces on this page shall be filled in at time of installation.

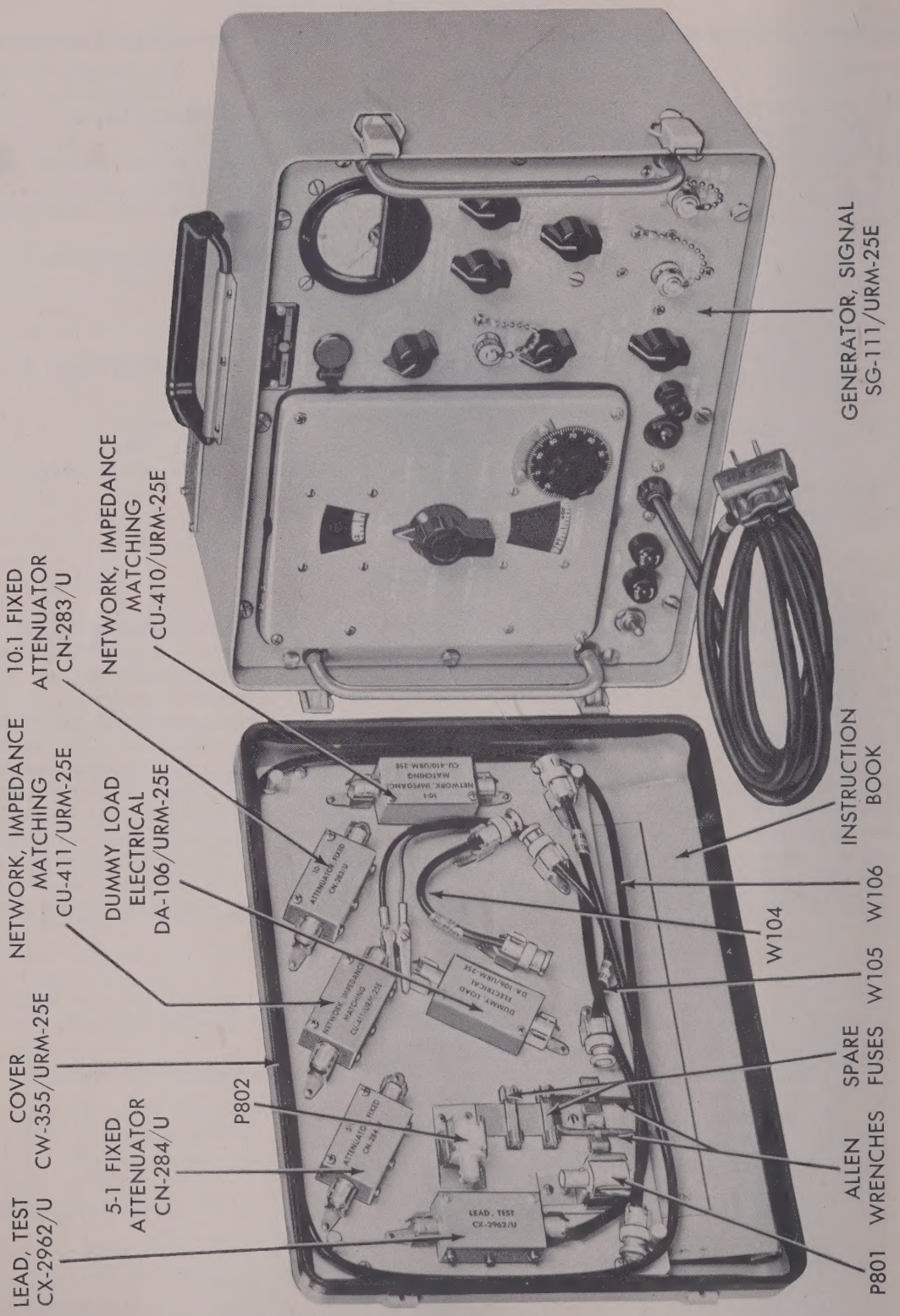


Figure 1—1. RF Signal Generator Set AN/URM-25E, Complete Equipment

SECTION 1

GENERAL DESCRIPTION

1. INTRODUCTION.

This instruction book contains information relative to the installation, operation, and maintenance of R.F. Signal Generator Set AN/URM-25E.

2. PURPOSE AND BASIC PRINCIPLES.

The R.F. Signal Generator Set AN/URM-25E is a test equipment designed to operate from a 115-volt, single-phase, 50 to 1000 cycle a-c power source. It is intended primarily for field use in the general maintenance and servicing of electronic equipment.

The functional principle of the AN/URM-25E is similar to that of a radio frequency transmitter. Known radio frequency signals continuously variable from 0.1 to 100,000 microvolts either modulated or unmodulated, can be generated over a continuous range of frequencies from 10 to 50,000 kilocycles.

3. REFERENCE DATA.

a. Nomenclature. — R.F. Signal Generator Set AN/URM-25E.

b. Contract. — NObsr-63060, 30 September 1952.

c. Contractor. — Harvey-Wells Electronics, Inc., Southbridge, Massachusetts.

d. Cognizant Naval Inspector. — Inspector of Naval Material, Boston, Massachusetts.

e. Number of Packages Involved Per Complete Shipment. — One

f. Total Cubical Contents. — See Table 1—1 and 1—3.

g. Total Weight. — See Table 1—1 and 1—3.

h. Frequency Range. — 10 kc to 50,000 kc accurate to within ±0.5% when using direct reading frequency scale. Equipment overall frequency accuracy of ±0.05% can be obtained from 1 mc to 50 mc when calibrated against integral crystal.

i. Tuning Bands and Ranges: —

(1) Band A — 10 to 30 kc
(2) Band B — 30 to 95 kc
(3) Band C — 95 to 300 kc
(4) Band D — 300 to 950 kc
(5) Band E — 0.95 to 3 mc
(6) Band F — 3 to 9.5 mc
(7) Band G — 9.5 to 30 mc
(8) Band H — 30 to 50 mc

j. Types of Modulation: — Amplitude Modulation 0 to 50% (indicated accuracy within ±10% of full scale reading).

(1) Internal modulation frequencies: —
(a) 400 cycles per second ±5%.
(b) 1000 cycles per second ±5%.

(2) External modulation frequencies: — 100 to 15,000 cycles per second.

k. R.F. Output Voltage: —

(1) Across 50-ohm external load: — 10 kc to 50 mc range — 0.1 to 100,000 microvolts ±10% continuously adjustable.

(2) Open circuit voltage at X-200K output jack — 2.0 volts at any frequency within the range of the equipment.

l. Audio Output Voltage (400 or 1000 c.p.s.): — 0 to over 3 volts adjustable, across an output impedance of approximately 15,000 ohms. Voltage calibration proportional to reading of % Modulation.

m. Output Impedance: —

(1) 50 ohms at the RF OUTPUT X MULT jack (J-102).

(2) 500 ohms at the RF OUTPUT X 200K jack (J-101).

(3) 15,000 ohms at EXT MOD IN-AUDIO OUT-XTAL CAL OUT jack (J-105) for crystal calibration monitoring; 33,000 ohms for external modulation input.

n. Power Source Requirements: — 115 volts ±10%, 50 to 1000 cycles per second, single-phase.

o. Power Consumption of Equipment: — Approximately 48 watts.

4. DESCRIPTION OF EQUIPMENT.

a. General. — The portable, self-contained AN/URM-25E equipment (see Figure 1—1.) consists essentially of the following main components:

(1) Generator, Signal SG-111/URM-25E.
(2) Cover, Signal Generator CW-355/URM-25E.

b. Generator, Signal SG-111/URM-25E. — The Signal Generator, which includes Power Supply PP-1205/URM-25E, is enclosed in an aluminum fabricated case with a carrying handle on top. The signal generator proper which contains all the RF, modulator and step attenuator circuits and components required for generation of the output signal on a panel-chassis type assembly occupies the front part of the enclosing case. All input and output connectors along with the controls required for operation of the equipment are located on the front panel. The RF sections of this unit are completely enclosed in shielded compartments within an aluminum casting mounted on the left-hand rear side of the front panel. A rotating turret containing RF oscillator coils designed for different frequency ranges is used to cover the overall RF frequency range of the Signal Generator in eight overlapping bands. Frequency band switching is accomplished by means of a band selector switch on the front panel. Frequency adjustment within each band is obtained by means of a vernier driven straight line frequency capacitor. Frequency indication within an accuracy of ±0.5% is provided on a front panel frequency scale. Frequency accuracy within ±0.05% above 1 mc is also made possible by means of a 1-mc crystal calibrator incorporated in this unit.

The modulator is a separate assembly mounted on the right-hand rear side of the front panel. It functions to provide the 400 or 1000-cycle per second signal used for amplitude modulation of the RF carrier from 0 to 50

percent. Provisions are also made for using an external source of 100 to 15,000-cycle audio voltage for modulation purposes where modulating frequencies other than 400 or 1000 cycles per second are required.

A front panel mounted microammeter is calibrated to provide percentage modulation indication. This meter is also used in conjunction with the step attenuator to indicate RF output level.

The attenuator section of the Signal Generator consists of a variable RF step ladder network contained in an aluminum casting mounted below the modulator unit assembly on the rear of the front panel. This assembly provides for varying the RF output voltage by factors of ten.

The Power Supply PP-1205/URM-25E, which includes the power transformer, rectifier and other components required to supply all the necessary operating voltages for this equipment, is contained on a separate chassis located in the rear of the enclosing case. Connections between the Power Supply and the other sections of the Signal Generator are made by means of two interconnecting cables.

c. Cover, Signal Generator CW-355/URM-25E.— The Signal Generator Cover is a completely detachable assembly designed to protect the operating panel and controls and to provide storage for equipment accessories when the equipment is not in use.

Accessories supplied with the AN/URM-25E and contained in the Signal Generator covers are as follows:

(1) Attenuator, Fixed CN-283/U consisting of a 50-ohm resistive network for providing a fixed ratio of input to output voltage of 10 to 1 when terminated in a 50-ohm load. It is intended for use with the Signal Generator when a high degree of voltage accuracy is desired for low level outputs on the 30 – 50 mc band.

(2) Attenuator, Fixed CN-284/U for providing a fixed input to output voltage ratio of 5 to 1 when terminated in a 50-ohm load. It is intended for use with the Signal Generator when checking output levels below "2" (20,000;2,000;20;2;0.2 mv) where the meter accuracy tends to fall off.

(3) Network, Impedance Matching CU-410/URM-25E for providing impedance matching when the Signal Generator is used with loads of approximately 70-ohms impedance (10:1 voltage ratio).

(4) Network, Impedance Matching CU-411/URM-25E for providing impedance matching when the AN/URM-25E is used with loads of over 500-ohms impedance.

(5) Lead, Test CX-2962/U for use in making interstage receiver measurements. When thus used, this unit which is essentially a capacitance coupling device protects the step attenuator in the Signal Generator output circuit from accidental test probing at points of B+ potential.

(6) Dummy Load, Electrical DA-106/URM-25E for use when making overall measurements or tests on a receiver designed for use with a standard antenna. This unit is identical to the RETMA standard dummy load and simulates an actual antenna.

(7) Cable Assemblies RF CG-409/U (6″) for RF output connections.

(8) Cable Assembly RF CG-409/U (4′) for RF output connections.

(9) Spare fuses.

(10) Connector Adapter UG-201/U to adapt the BNC connectors on the ends of the R.F. cable assemblies to type N connector receptacles.

TABLE 1—1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	OVER-ALL DIMENSIONS (INCHES)			VOLUME (CU. IN.)	WEIGHT (LBS.)
			HEIGHT	WIDTH	DEPTH		
1	R.F. Signal Generator Set, includes:	AN/URM-25E	11¼	14⅛	10⅝	1688	36¼
1	Generator, Signal	SG-111/URM-25E					
1	Power Supply	PP-1205/URM-25E					
1	Cover, Signal Generator	CW-355/URM-25E					
2	Cable Assembly, R.F.	CG-409/U (6″)					
1	Cable Assembly, R.F.	CG-409/U (4′)					
1	Lead, Test	CX-2962/U					
1	Network, Impedance Matching	CU-410/URM-25E					
1	Network, Impedance Matching	CU-411/URM-25E					
1	Attenuator, Fixed	CN-283/U					
1	Attenuator, Fixed	CN-284/U					
1	Dummy Load, Electrical	DA-106/URM-25E					
2	Instruction Books	NAVSHIPS					

(11) Connector Adapter UG-273/U to adapt the BNC connectors on the R.F. cables to type UHF connectors.

(12) Allen wrenches three for size 6, 8, and 10 screws.

The Fixed Attenuator, Impedance Matching Network, and Dummy Load units are contained in separate two section rectangular aluminum housings approximately 2 inches long by 1-5/16 inches high by 1-3/16 inches wide with a type UG-625A/U connector on each end. The Test Lead CX-2962/U is also contained in an aluminum housing similar to the Fixed Attenuators excepting for the two approximately 16-inch long clip leads that extend from one end.

5. EQUIPMENT SIMILARITIES.

a. The AN/URM-25E is basically similar to the AN URM-25D. Differences between the two equipments are noted in Table 1—3. Though similar in operation to previous models, these two models incorporate basically different mechanical and electrical designs along with frequency range divisions and output impedance value differences.

TABLE 1—2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

NAME OF UNIT	NAVY TYPE DESIGNATION	REQUIRED USE
Crystal Calibrated Frequency Indicating Equipment	Model LM or AN/URM-82 or equivalent	Testing, Trouble Shooting, Calibrating and Adjustments of AN/URM-25E
Heterodyne Frequency Meter and Crystal Controlled Calibration Equipment	AN/USM-29 or equivalent	
Signal Generator	TS-535/U	
Resistance Bridge	ZM-4/U	
Electronic Multimeter	AN/USM-34, ME-25/U Series or equivalent	
Oscilloscope	OS-8/U or equivalent	
Tube Tester	TV-3/U Series or equivalent	
Megohmmeter, Insulation Tester	AN/PSM-2	
Multimeter	AN/PSM-4, TS-352/U, Navy Model OE Series Receiver Analyzing Equipment	

TABLE 1—3. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVER-ALL DIMENSIONS			VOLUME	WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	RF Signal Generator Set and Equipment Spares	AN/URM-25E	15½	22	14	2.76	58

Unless otherwise stated, dimensions are in inches, volume cubic feet, weight in pounds.

TABLE 1—4. BASIC DIFFERENCES IN AN/URM-25 SERIES EQUIPMENT

MODEL	LINE CORD	"EXT MOD IN" FILTER	FREQUENCY SCALE LAMP FILTER	CRYSTAL CALIBRATOR	RF PEAKING COIL	POWER SUPPLY	OTHER ITEM DIFFERENCES
AN/URM-25	Cord-Filter CX-1595/URM-25	Single section unshielded	none	none	One peaking coil for Band H (L-114)	L-201, T-201 Non JAN types	
AN/URM-25A	Line cord Sym No. W-101	Triple section shielded	Triple section shielded	none	One peaking coil for Band H (L-114)	RF bypasses C-205, C-206 added; L-201, T-201 JAN types	RF bypasses C-147, C-148 added to line filter
AN/URM-25B	Line cord Sym No. W-101	Triple section shielded in addition to an unshielded choke	Triple section shielded	V-108 (6BE6) crystal calibrator	Two peaking coils (L121, L-122), effective from 16 mc to 50 mc	RF bypasses C-205, C-206 added; L-201, T-201 JAN types	C-108 (.5 mf) removed. Adapter Connector UG-684/U added, C-149, C-156, E-131 and C-118 added, C-113 changed from 10,000 mmf to 6200 mmf, other wiring changes
AN/URM-25C	Line cord Sym No. W-101	Triple section shielded in addition to an unshielded choke	Triple section shielded	V-108 (6BE6) crystal calibrator	Two peaking coils (L-121, L-122), effective from 16 mc to 50 mc	RF bypasses C-205, C-206 added; L-201, T-201 JAN types	6J4 (Buffer Amplifier) replaced by two 6AH6; 9004 (RF Diode) replaced by IN34 crystal; other circuit and component changes as required for above
AN/URM-25D	AC Line Cable Assembly CX-2647/U (6' ⅝")	Single "L" section LC filter	none	V-105 (5750) crystal calibrator	Pass band accomplished with M-derived filter	Voltage Stabilizer changed to V-108 (OA2); R-201 is 3100 ohms, 12.5 watts	Entire tube complement and associated circuitry differs from preceding models
AN/URM-25E	Integral part of Signal Generator	Single "L" section LC filter	none	V-105 (5750) crystal calibrator	Pass band accomplished with M-derived filter	Voltage Stabilizer V-108 changed to OA2WA type. R-201 is 3100 ohms, 12.5 watts	Meter circuit component values changed. Additional adapters furnished. Otherwise, similar to D model

TABLE 1–5. ELECTRON TUBE COMPLEMENT

NUMBER REQUIRED	TUBE TYPE	SYMBOL DESIG.	FUNCTION	LOCATION
1	6AH6	V101	Carrier Oscillator	Carrier Oscillator Compartment
1	6AH6	V102	Buffer Amplifier	Buffer Amplifier Compartment
1	6AG7	V103	RF Amplifier	Buffer Amplifier Compartment
1	5726	V104	Vacuum Tube Voltmeter	Buffer Amplifier Compartment
1	5750	V105	Crystal Calibrator Oscillator	Carrier Oscillator Compartment
1	5814A	V106	Modulation Oscillator	Audio Compartment
1	6AH6	V107	Cathode Follower	Audio Compartment
1	OA2WA	V108	Voltage Regulator	Audio Compartment
1	6X4W	V201	Rectifier	Power Supply

SECTION 2
THEORY OF OPERATION

1. GENERAL.

The functional principle of the AN/URM-25E, shown in block diagram form in figure 2–1, is similar to that of a radio frequency transmitter. Variable RF signals are generated by an RF oscillator and fed via a buffer stage and an output amplifier stage to a step attenuator where the desired output amplitude is selected.

Amplitude modulation of the RF signal can be accomplished, if desired, by using either the output from the modulation oscillator or an external audio source connected to the EXT MOD IN – AUDIO OUT – XTAL CAL OUT jack (J105). Selection of the desired audio signal for modulation purposes is accomplished

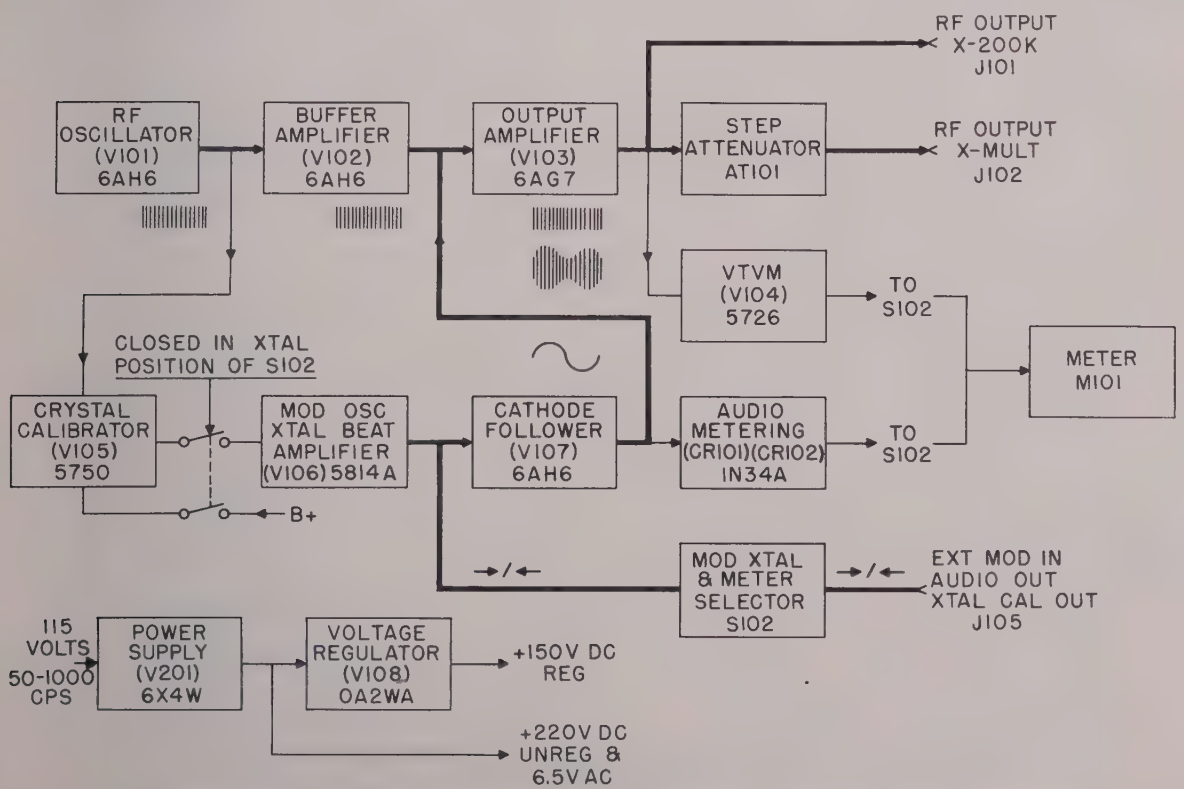

RF OUTPUT X-200K J101
RF OSCILLATOR (V101) 6AH6
BUFFER AMPLIFIER (V102) 6AH6
OUTPUT AMPLIFIER (V103) 6AG7
STEP ATTENUATOR AT101
RF OUTPUT X-MULT J102
VTVM (V104) 5726
TO S102
METER M101
CLOSED IN XTAL POSITION OF S102
CRYSTAL CALIBRATOR (V105) 5750
MOD OSC XTAL BEAT AMPLIFIER (V106) 5814A
CATHODE FOLLOWER (V107) 6AH6
AUDIO METERING (CR101)(CR102) IN34A
TO S102
B+
MOD XTAL & METER SELECTOR S102
EXT MOD IN AUDIO OUT XTAL CAL OUT J105
115 VOLTS 50-1000 CPS
POWER SUPPLY (V201) 6X4W
VOLTAGE REGULATOR (V108) OA2WA
+150V DC REG
+220V DC UNREG & 6.5V AC

Figure 2–1. RF Signal Generator SG-111/URM-25E, Functional Block Diagram

by means of the MOD XTAL & METER SELECTOR (S102) switching arrangement, which routes the modulation signal via a cathode follower stage to the grid circuit of the output amplifier where modulation takes place. This switching arrangement also provides a means of making the internally generated audio signal available at the EXT MOD IN – AUDIO OUT – XTAL CAL OUT jack (J105).

Separate VTVM and audio metering circuits using the same meter are provided for indication of carrier output level or percentage modulation. The metering circuit used and the indication provided depend upon the position of the MOD XTAL & METER SELECTOR.

The crystal calibrator stage is provided for use with a vernier dial control for interpolative calibration where RF frequency accuracies within $\pm 0.05\%$ are desired. When this stage is used, its audio beat output is fed via the V106 stage, which when used with the crystal calibrator acts as a beat amplifier, and S102 to jack J105 where the signal is available for monitoring purposes.

2. CIRCUIT ANALYSIS.

a. General. – A detailed analysis of the principle circuits used in this equipment is covered in this section under the following headings:

(1) RF Oscillator
(2) Buffer Amplifier
(3) Output Amplifier
(4) Step Attenuator
(5) Vacuum Tube Voltmeter
(6) Modulation Oscillator
(7) Cathode Follower
(8) Audio Metering
(9) Crystal Calibrator
(10) AC Power Input Circuit
(11) Power Supply PP-1205/URM-25E
(12) Voltage Regulator

b. RF Oscillator. –
(See figure 2–2)

The RF oscillator, which is located in a completely-enclosed, shielded compartment on the left-hand side of the RF signal generator set, makes use of a type 6AH6 (V101) triode-connected pentode in a conventional Hartley type oscillator circuit.

The frequency range (10 kilocycles to 50 megacycles) of the oscillator is covered in eight bands. Frequency adjustment within each of the various bands is accomplished by means of the variable main tuning capacitor (C123), which is mechanically coupled to a calibrated frequency scale on the front of the set for visual indication of the generated frequency. All frequency band switching is accomplished by means of a rotary turret selector switch, which contains eight adjustable iron core inductances (L101 through L108) and trimmer capacitors (C102-4-6-8-10-12-14 and 16).

In addition to selecting the applicable "inductance-capacitance" combination for the desired band, this switch also serves the following two functions:

(1) Selects the proper grid leak resistance, blocking capacitance, and cathode resistor combination for V101.

(2) Shorts both ends of the coil for the lower adjacent range to ground, thereby eliminating the dead spot due to resonance in the adjacent coil.

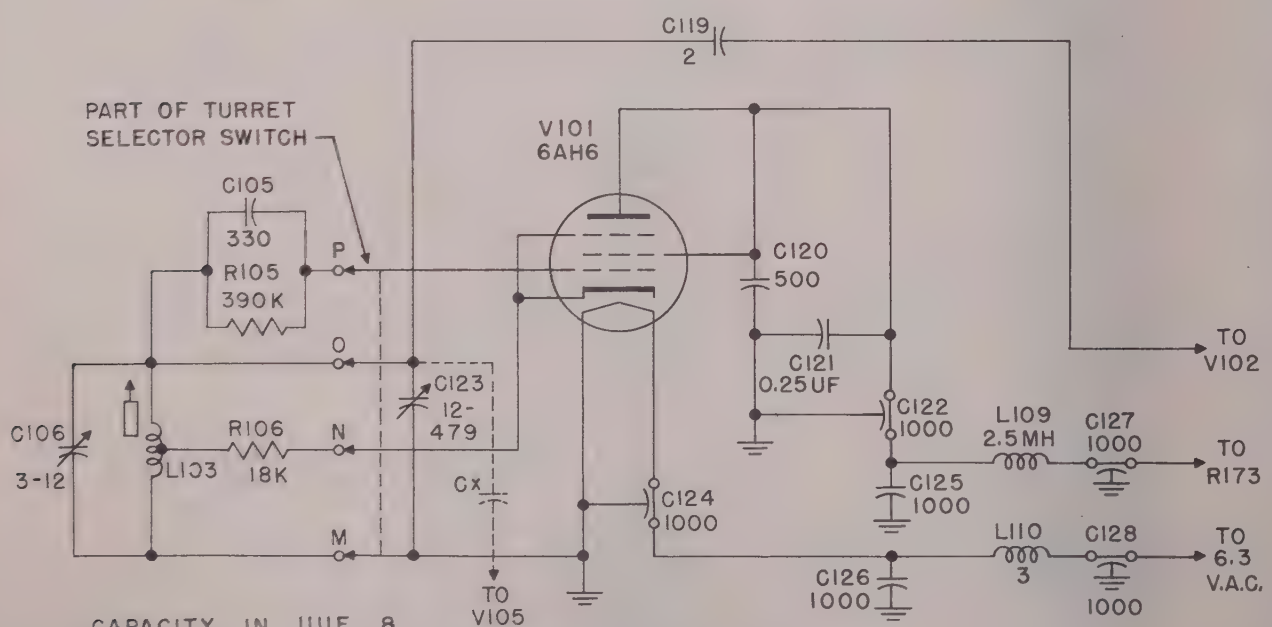


Figure 2–2. RF Oscillator, Simplified Schematic Diagram

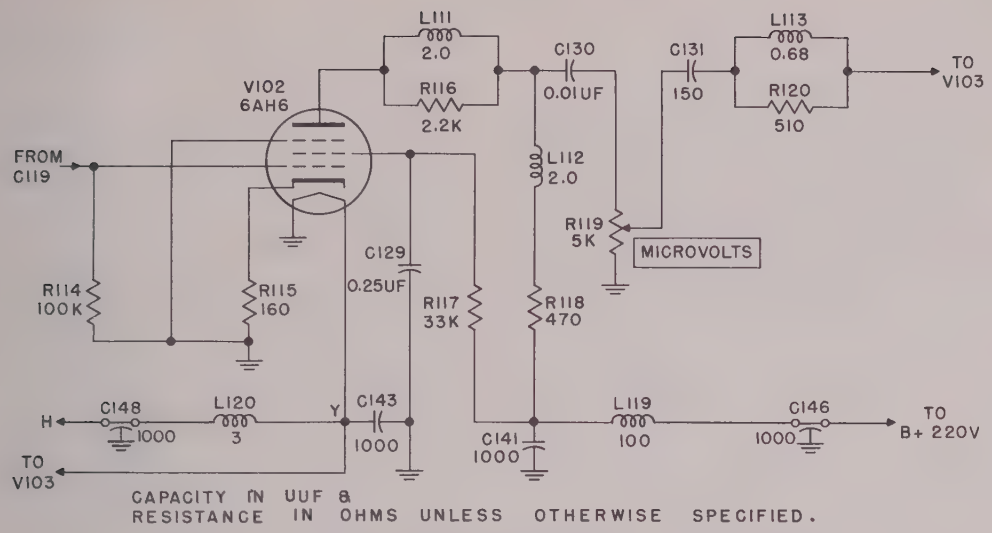


Figure 2–3. Buffer Amplifier, Simplified Schematic Diagram

The principal electrical features of the RF oscillator are shown in the simplified schematic diagram figure 2–2. For purposes of simplifying the circuit analysis and since the components and circuitry for all bands are similar, only those utilized when the turret selector switch is positioned at Band C are shown. In this position the frequency of oscillation is determined by the "inductance-capacitance" combination of L103, C106, and C123. Trimmer capacitor (C106) in conjunction with the tuning slug adjustment of L103 is used in setting the range of the band covered by the main tuning capacitor (C123). Resistor R106 functions to stabilize the oscillator by isolating the tuning circuit from the oscillator tube (V101), the parameters of which vary with changes in temperature, heater voltages, etc. R105 and C105 are used to obtain automatic grid bias for the oscillator tube. The plate of this tube is maintained at r-f ground potential at all frequencies generated by means of bypass capacitors (C120) and (C121) effective at high and low frequencies respectively. The regulated B+ plate supply for this tube enters the oscillator compartment by means of feed-through capacitor (C127), which is part of a low-pass filter composed also of L109 and C125. This r-f filter is used to prevent r-f leakage out of the oscillator compartment via the B+ supply lead. A similar arrangement composed of C128, L110 and C126 is used to filter the filament supply. The output of the RF oscillator is coupled to the succeeding buffer amplifier stage by means of the coupling capacitor (C119). The low-capacity value of this capacitor enables it to isolate and minimize any effects resulting from variations in the external shunt capacitance of the succeeding stage. A small fraction of the r-f output is also capactively coupled to the crystal calibrator for crystal calibration puposes. The capacitive coupling, represented by C_x on the schematic diagram, is accomplished by using wire lead, positioned in the oscillator compartment and connected to the mixer grid of V105 in the crystal calibrator, to pick up stray r-f leakage within the oscillator.

c. Buffer Amplifier. — (See figure 2–3)

The buffer amplifier which is enclosed in a shielded compartment along with the output amplifier stage, uses a type 6AH6 pentode tube (V102) in an untuned RF amplifier circuit. Electrically, it is located between the RF oscillator and the output amplifier stage. It functions to amplify the r-f signal and to make the RF oscillator independent of the setting of the MICROVOLTS control (R119) and the step attenuator (AT101) as well as isolating it from the effects of output loading and modulation voltages.

Coupling of the r-f signal from the RF oscillator to the grid of V102 of this stage is accomplished by means of coupling capacitor (C119) and resistor R114. The operating point of V102 is established by the un-bypassed cathode bias resistor (R115). Condenser C129 serves to hold the screen grid of V102 essentially at r-f ground. Condenser C141 along with filter coil (L119) and feed-through capacitor (C146) form an r-f filter for the plate and screen grid B+ supply. The filament supply, which is common for the buffer amplifier, the output amplifier and the VTVM stages, is similarly filtered.

The signal output of this stage is coupled to the output amplifier stage by means of a frequency compensating network which consists essentially of L111, R116, L112, R118, L113 and R120. Its effect is to tend to stabilize the output impedance of the circuit from the shunting effects of the tube and interwiring capacitance at the higher frequencies. This type of compensation is necessary because of the extreme frequency range (10 kc to 50 mc) of the pass band required. Capacitor C130 in the output circuit serves primarily as a d-c blocking capacitor while C131 serves as a coupling capacitor for the r-f output and also as a blocking capacitor to prevent the bypassing of the higher audio frequencies used for grid modulation in the next stage. Variable resistor R119, marked MICROVOLTS, serves as a gain control.

d. Output Amplifier. — (See figure 2–4)

The output amplifier, which operates as a class A amplifier, uses a type 6AG7 power pentode type tube (V103) to amplify the r-f output signal of the buffer stage that appears at its grid. Bias for the V103 tube is obtained by the d-c voltage drop across the cathode resistor (R123). The parallel combination of capacitors C132 and C133 is used for r-f signal bypassing. Resistors R121 and R122 provide the grid return for V103. R122 is also used to introduce the audio signal for carrier amplitude modulation purposes.

The amplified output signal from the plate circuit of V103 is available either as a high-level signal voltage source having an internal impedance of approximately 500 ohms at jack J101, marked RF OUTPUT X-200K OPEN CIRCUIT, or as a low-level signal source with a constant 50 ohms internal impedance at jack J102, marked RF OUTPUT X-MULT. Selection of the output signal level desired is accomplished by means of the output/range switch (S101). When S101 is in the X-200K position, J101 and series resistor (R129) are connected to the output circuit. R129 increases the internal resistance of the source but serves to isolate it from capacitive loading by the output jack (J101). The voltage developed at this jack is not attenuated by the STEP ATTENUATOR (AT101). Its output level depends only upon the setting of the SET CARRIER control (R173) and the MICROVOLTS control (R119). When the output is fed via the STEP ATTENUATOR (AT101) to output jack (J102), S101 is placed in the X-MULT position to remove R129 from the output circuit and switch it to ground. This procedure assures minimum external leakage by removing the high voltage (2 volts) from the output jack J-101. Coupling to the r-f output circuits is accomplished by means of coupling capacitor (C135) and a frequency compensating network selected by the output/range switch (S101).

The frequency compensating networks compensate for the drop in frequency response at the lower and upper limits of the frequency band pass, and also function to prevent audio voltage from appearing in the equipment output when the mid or high carrier frequencies are modulated by audio frequencies up to as high as 15 kc. Compensation for the drop in frequency response at the lower frequencies is accomplished by effectively increasing the series capacitance in the output circuit, thereby reducing the reactance and permitting a sufficient amount of output signal voltage to appear across the output stage load, which consists essentially of the series combination of resistor R130 and the 55.56-ohm input impedance of the step attenuator (AT101). To do this, switch S101 is placed in the 10 kc — 300 kc position when operating the signal generator on bands A through C. In this position, S101 shorts out capacitor C136 which is in series with coupling capacitor (C135) and offers a high reactance to the lower frequencies. The drop in frequency response at the higher frequencies is compensated for by introducing an increase in the impedance in the output circuit. Inductances L114 and L115, which have little effect at the lower frequencies are used for this purpose. When the signal generator is operating at the higher frequencies (bands D through H), S101 is placed in the 300 kc — 50 mc position. In this position, capacitor C136 which offers a high reactance to the lower frequencies and a low reactance to the higher frequencies, is switched in to limit the audio modulating voltages from appearing in the output. Additional isolation of the output from audio frequency variations is achieved by the shorting out of the inductances L117 and L118, which represent plate load impedance needed for low-frequency operation.

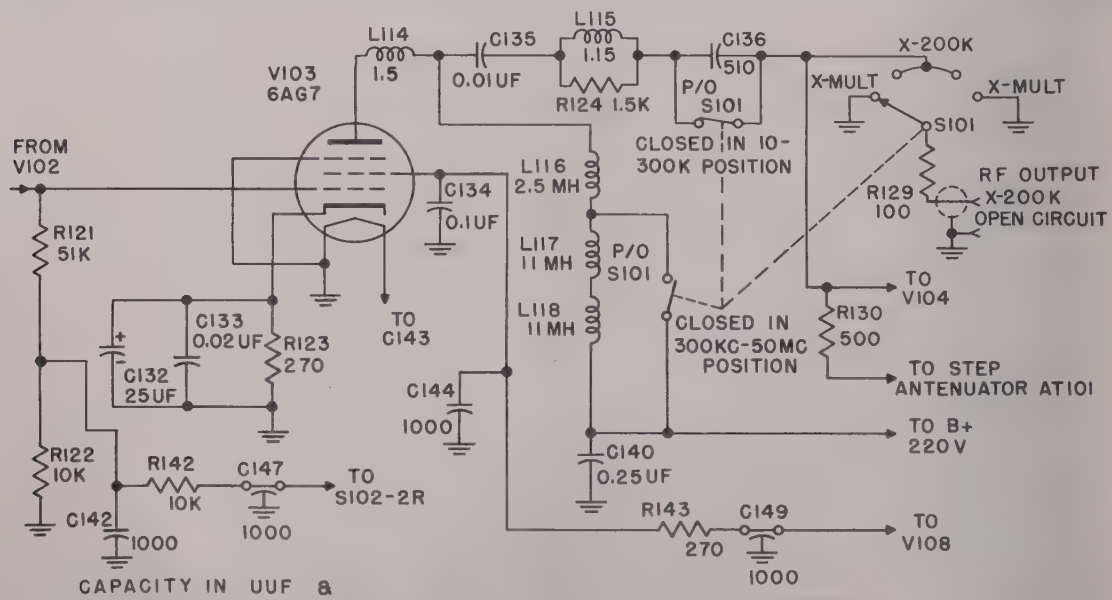


Figure 2–4. Output Amplifier, Simplified Schematic Diagram

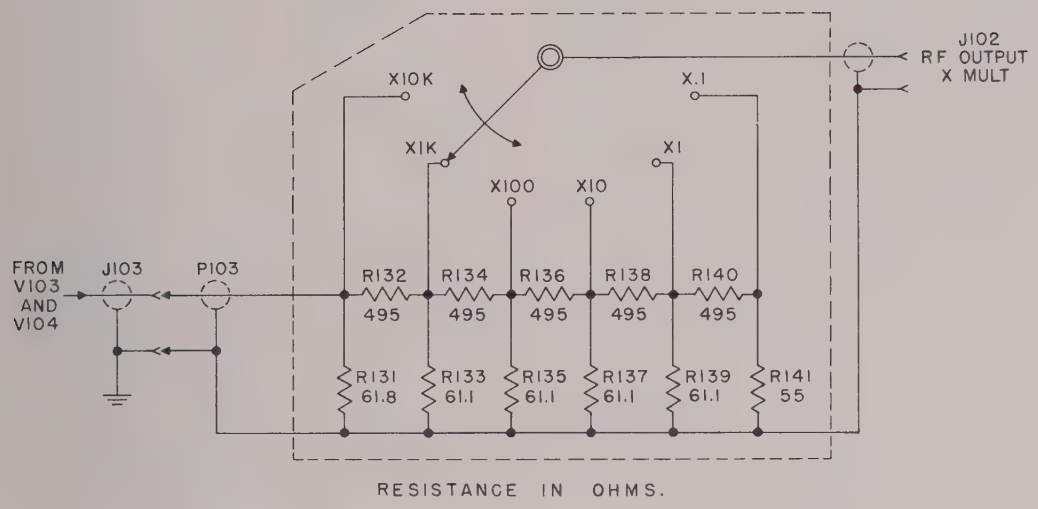


Figure 2–5. Step Attenuator, Simplified Schematic Diagram

e. Step Attenuator (AT101). – (See figure 2–5)

The step attenuator, which is essentially a variable step r-f ladder network, is used to attenuate in steps of ten the output amplifier output voltage fed via this circuit to the RF OUTPUT X-MULT jack (J102). The entire attenuator network is effectively resistive in nature so that the attenuation introduced is substantially independent of frequency within the limits of the Signal Generator. The output impedance of the attenuator system as taken from the RF OUTPUT X-MULT jack (J102) is constant at 50-ohms for any position of the attenuator.

The useful output voltage from J102 is always based on its being properly terminated in its characteristic impedance (50-ohms). Consequently, when the output from J102 is fed to a receiver under test, the reading on the signal generator output meter times the RF MULTIPLIER position of AT101 will be an indication of the input voltage to the receiver providing the carrier level was previously set at "10" on the meter by means of R173.

f. Vacuum Tube Voltmeter. – (See figure 2–6)

RF metering of the signal generator set output is accomplished by means of a VTVM type circuit connected across the output of the output amplifier stage.

The VTVM uses a type 5726 dual diode rectifier tube (V104) in conjunction with an output meter (M101) and associated circuitry. The first diode section of the

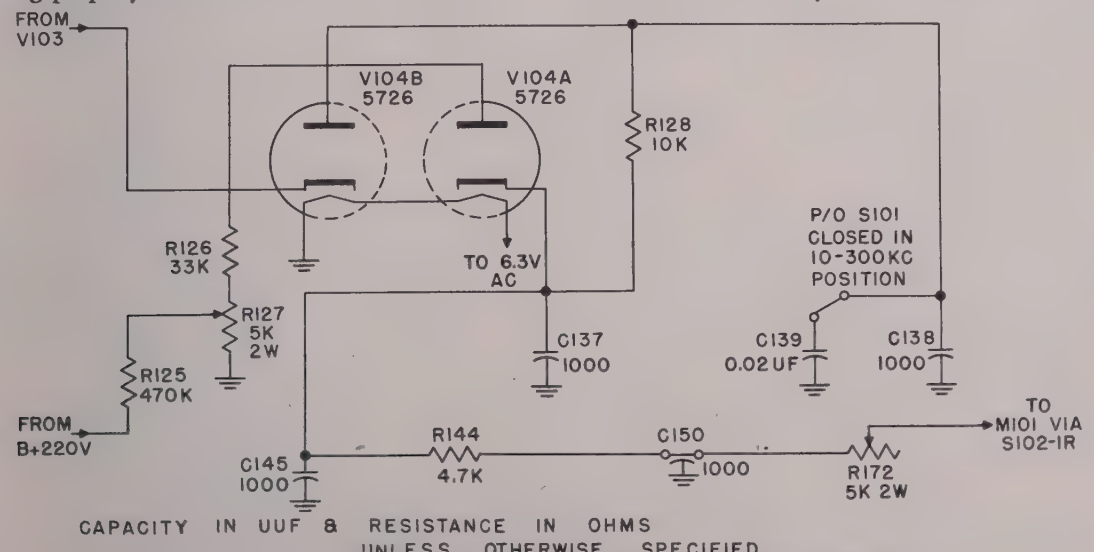


Figure 2–6. Vacuum Tube Voltmeter, Simplified Schematic Diagram

rectifier tube (V104B) rectifies the negative r-f signal peaks. The rectified r-f from V104B charges capacitor C138 to approximately the peak amplitude of the r-f output voltage. The voltage across C138 also appears across the series combination of R128, R144, R172 and M101. The resulting proportional d-c current is indicated on the upper scale of M101, which is calibrated from 0 to 10 microvolts to indicate the rms value of the output. Capacitor C139, which is switched in parallel with C138 when the output range switch (S101) is in the 10 kc – 300 kc position, provides for optimum values of capacity to be maintained over the entire frequency range. The residual potential of the peak rectifying diode which would exist as a result of the no-signal current through this diode is cancelled out by inserting the cathode of the second diode (V104A) at the junction of resistors R128 and R144. The plate of this diode is returned to ground through resistor R126 and potentiometer R127 (CARRIER METER ZERO). The arm of R127 is connected to R125 and then to B+. This forms a voltage divider allowing the positive voltage to bias the second diode and thus zero position the carrier meter (M101). This method offers better zero stability than a direct biasing of the rectifying diode.

g. Modulation Oscillator – Beat Amplifier. – (See figure 2–7)

The modulation oscillator utilizes a type 5814A dual triode tube (V106) in a standard Wien-bridge type oscillator circuit that is capable of generating an audio signal of either 400 or 1000 cycles per second, depending upon the position of the MOD XTAL & METER SELECTOR switch (S102). In this oscillator, tube V106 acts as a two-stage amplifier. Section V106B of the tube acts as the input amplifier, while V106A acts as an output amplifier and inverter. Thus, even without the bridge circuit, this system will sustain oscillation, since any signal that appears at the grid of V106B is amplified and inverted by both V106B and V106A. The voltage fed back to the grid of V106B will then reinforce the initial signal and cause oscillations to be set up and maintained. However, since this system could cause oscillations over a wide range of frequencies, the frequency-selective resistance-capacitance bridge circuit is used to eliminate feedback voltages of all frequencies excepting the single frequency desired in the output. The frequency of this voltage is such that the output voltage of V106A is in phase with the original signal across R153/R155 (input signal to V106B) and the positive feedback exceeds the negative feedback. Feedback voltages of all other frequencies are attenuated by a high degree of degeneration as a result of the phase shift provided by the bridge circuit. Thus, insufficient feedback voltage is available at these frequencies to sustain oscillation.

The degenerative or negative feedback voltage necessary to obtain good waveform in the oscillator output is supplied via resistors R156, R158, R159, and variable feedback control (R157). The variable feedback control (R157) is preset to sustain oscillation at both 400 and 1000 cycles per second, with minimum distortion.

Regeneration or positive feedback is provided by a voltage divider consisting of the combination of R152, R153, C160, and C161 for the 400-cycle frequency determining network. For 1000-cycle operation, R154 and R155 are switched in to the circuit, replacing resistors R152 and R153. At very high frequencies, the reactance of C161 is low and any positive feedback voltage applied to the grid of V106B will be at a minimum. At very low

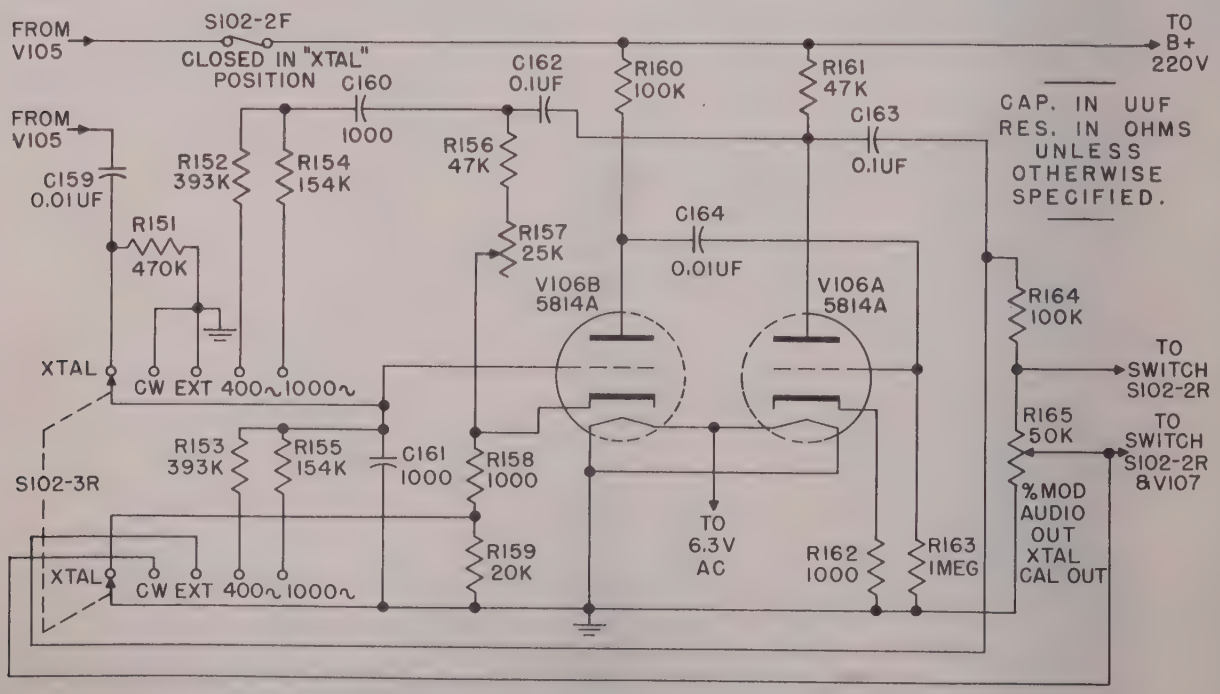


Figure 2–7. Modulation Oscillator, Simplified Schematic Diagram

frequencies the reactance of C160 will be high and the positive feedback voltage applied to the grid of V106B will subsequently be low. It can be shown that for maximum regeneration at the desired frequency, the voltage across resistor R153 will be in phase with the output from V106A when R152 X C160 = R153 X C161. Capacitor C162 in the feedback path serves as a d-c blocking capacitor.

The audio voltage output of the modulation oscillator is developed across the plate load resistor (R161) of the second amplifier stage and is coupled by means of capacitor C163, series network of isolating resistor (R164) and % MOD AUDIO OUT XTAL CAL OUT potentiometer (R165) to the cathode follower stage. By means of R165, the amplitude of the audio output voltage can be varied, thereby, controlling the degree of modulation of the r-f signal or the amount of audio output available at jack J105.

Besides functioning as an internal audio source, the modulation oscillator also serves as a two-stage beat amplifier when the MOD-XTAL & METER SELECTOR (S102) is placed in the XTAL position. In this position, the audio beat output voltage from the Crystal Calibrator (V105) stage is applied to the grid of V106B via the S102-3R section of S102. The output of the first amplifier section is coupled by C164 to the grid of the second amplifier section. The output signal of the beat amplifier is developed across plate load resistor R161. This signal is coupled via coupling capacitor (C163), the R164 and R165 network, cathode follower stage, and the S102-2R section of the MOD – XTAL & METER SELECTOR to J105 where it is available for monitoring purposes with headphones or other indicating device.

b. Cathode Follower. – (See figure 2–8)

This stage uses a type 6AH6 triode-connected pentode tube (V107) in a modified cathode follower type circuit. This circuit is electrically connected between the modulation oscillator and the output amplifier. Its primary function is to isolate the modulation oscillator from the effects of a varying load and to act as an impedance lowering device for coupling the output of the modulation oscillator to the output amplifier stage. Operation of this circuit is essentially the same as any conventional cathode follower excepting for the method of tube biasing. When the MOD XTAL & METER SELECTOR (S102) is in any one of the modulation positions, an audio signal is fed via R165 and coupling capacitor (C165) to the grid of V107. This signal produces a plate current variation through the unbypassed cathode resistor (R167 and R168); across which the output is taken. Capacitor C166 is used to couple the output via S102-2R to the output amplifier stage for modulation purposes. A portion of the output signal is also coupled by means of C167 to an audio metering circuit for percentage modulation indication purposes. When S102 is placed in the XTAL position, the output signal is routed through the XTAL contact of S102-2R to jack J105 rather than to the output amplifier to permit monitoring of the audio beat signal with headphones or other indicating device.

Grid bias for V107 is obtained by terminating grid return resistor (R166) to the junction of cathode resistors (R167 and R168). By terminating the grid return at this point rather than at the more negative ground point, as in conventional cathode followers, a bias somewhat lower than the normal cathode resistor voltage drop used

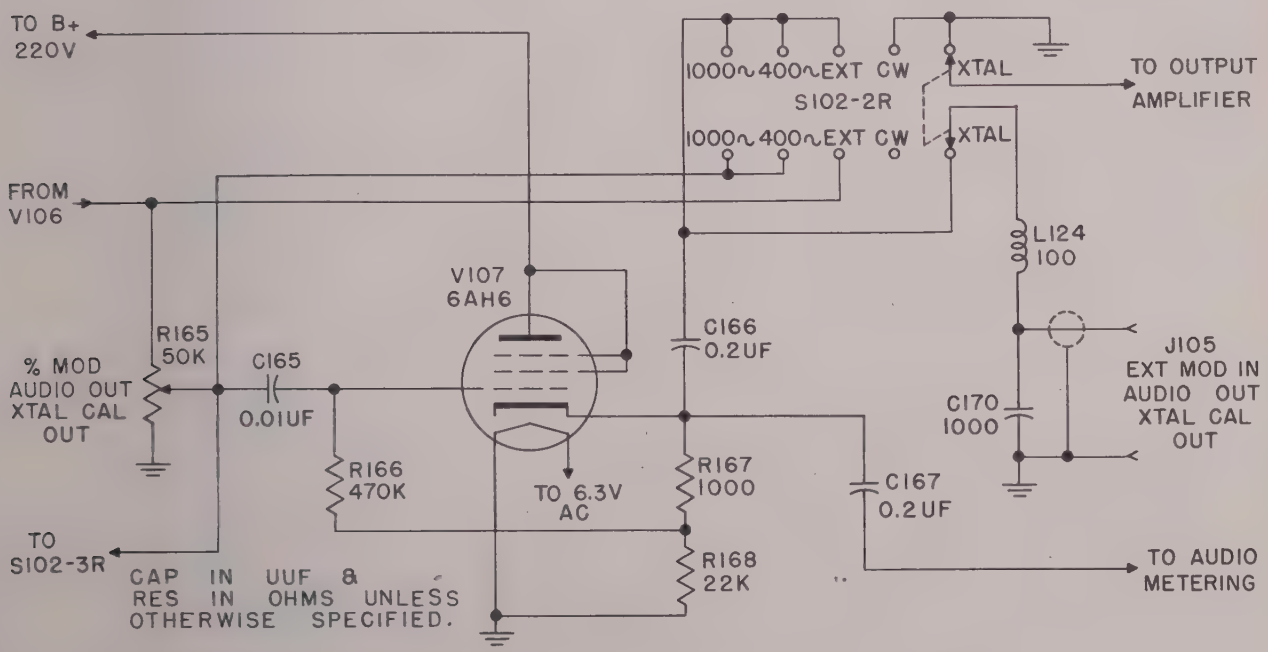


Figure 2–8. Cathode Follower, Simplified Schematic Diagram

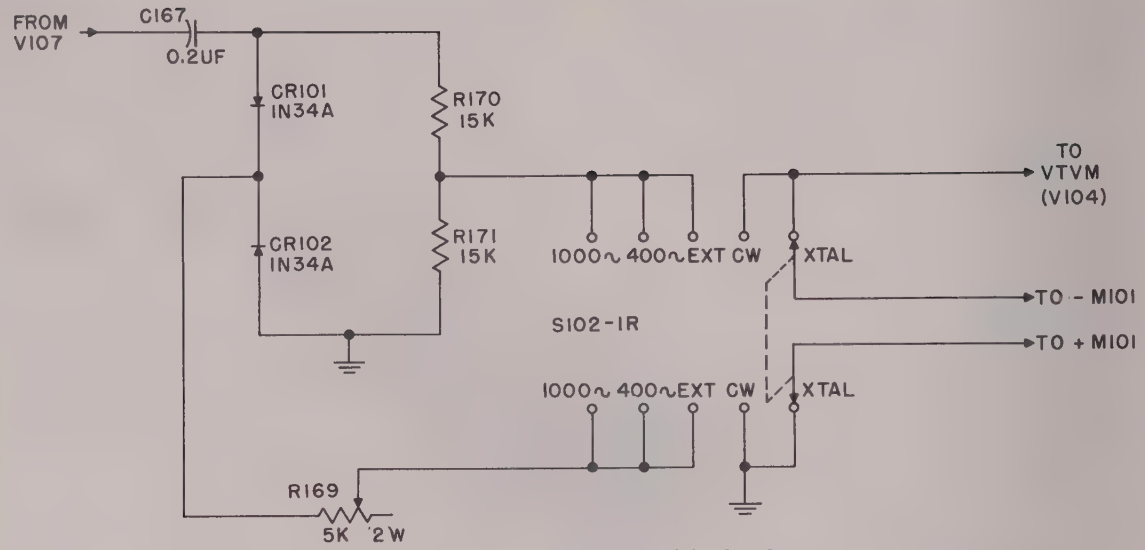


Figure 2–9. Audio Metering Circuit, Simplified Schematic Diagram

for bias purposes is obtained. Reducing the bias functions to eliminate the effects of cut-off limiting of negative signals resulting from the degeneration action of the output voltage appearing across the cathode resistors.

i. Audio Metering Circuit. –
(See figure 2–9)

The function of the audio metering circuit is to provide an indication of the degree of modulation of the r-f carrier as a percentage. Since in a grid modulation circuit such as that used in the output amplifier the degree of modulation is a function of the audio voltage level, the percentage modulation can be obtained by measuring the amplitude of the audio voltage. To measure the audio voltage, a full wave type rectifier, utilizing two type IN34A crystal diodes (CR101, CR102) in conjunction with meter M101 and resistors R110 and R171, is used. The modulation voltage output of the cathode follower stage is applied across the rectifier circuit where it is rectified. The resulting d-c current, which is directly proportional to the audio voltage, flows through M101 which provides the percentage modulation indication on a scale calibrated for this purpose. The S102-1R section of the MOD XTAL & METER SELECTOR is used to connect the M101 meter to the audio metering circuit when amplitude modulating the r-f carrier.

j. Crystal Calibrator. –
(See figure 2–10.)

The crystal calibrator is incorporated in the RF oscillator compartment of the equipment. It provides crystal check points from 1 mc to 50 mc which are used in con-

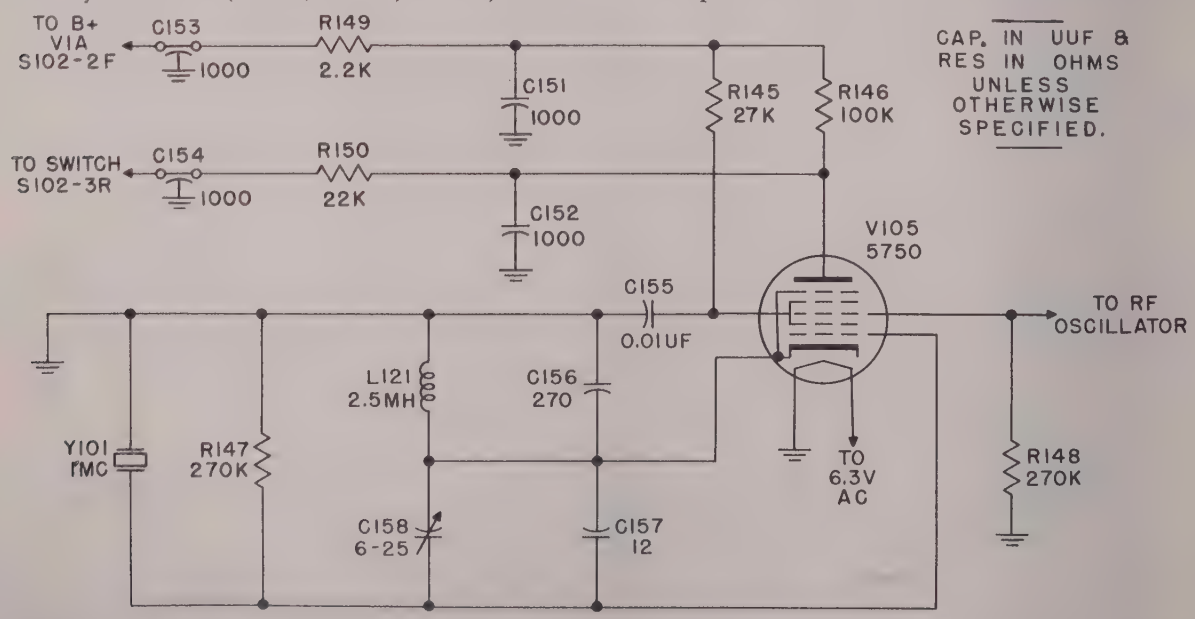


Figure 2–10. Crystal Calibrator, Simplified Schematic Diagram

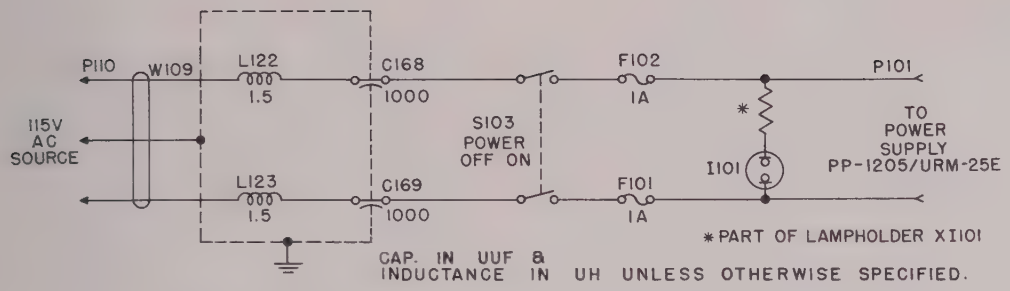


Figure 2–11. AC Power Input Circuit, Schematic Diagram

junction with the vernier frequency dial control on the front panel of the equipment for interpolative calibration of the signal generator in this frequency range. The overall frequency accuracy of the equipment for the above frequency range when checked against the crystal calibrator, including all variations of operating conditions, is within ±.05%. No provision is made for integral calibration below 1 mc where the accuracy is that of the direct reading frequency scale (±0.5%).

Operation of this stage is controlled by the MOD XTAL & METER SELECTOR switch (S102). This switch permits d-c operating voltages to be supplied to this stage only when it is in the XTAL position. The type 5750 pentagrid converter tube (V105) used in this stage, performs the dual function of a triode crystal oscillator and mixer. In the crystal oscillator portion of V105, the No. 2 grid (pin 6) acts as the plate of a triode with the No. 1 grid (pin 1) and the cathode (pin 2) forming the remainder of the triode. The crystal oscillator circuit is a grounded plate type. The B+ operating voltage is supplied to the No. 2 grid via R145. This grid is kept at r-f ground by capacitor C155. The frequency of oscillation is controlled by the quartz crystal (Y101). Variable capacitor (C158) acts as a trimmer for adjusting the 1 mc frequency against a primary standard. The combination of capacitor C156 and coil L121 are used to provide the necessary feedback to sustain oscillation. The mixing of the crystal oscillator signal with a small portion of the r-f signal, which is capacitively coupled from the RF oscillator to the mixer grid (pin 7) of V105, results in sum and difference beat notes. This audio beat signal is fed, via the low-pass filter (R150, C154) and coupling capacitor C159, to the grid of V106B where it is amplified and fed to jack J105 for monitoring purposes. Capacitor C152 serves to bypass any r-f components in the output of this stage to ground. Resistor R146 acts as the plate load impedance for V105.

k. AC Power Input Circuit. –
(See figure 2–11)

The RF Signal Generator Set operates from a single-phase a-c source of potential of 115 volts ±10%, 50 to 1000 cycles per second. Power input cable (W109), located on the front panel of the equipment, provides a means of connecting the equipment to the power source. On-off control of the a-c power input is provided by means of the POWER ON-OFF switch (S103). Power on indication is provided by the neon indicating lamp I101. Fuses F101 and F102 in the a-c input lines provide the necessary overload protection for the equipment. The network formed by capacitors C168 and C169 along

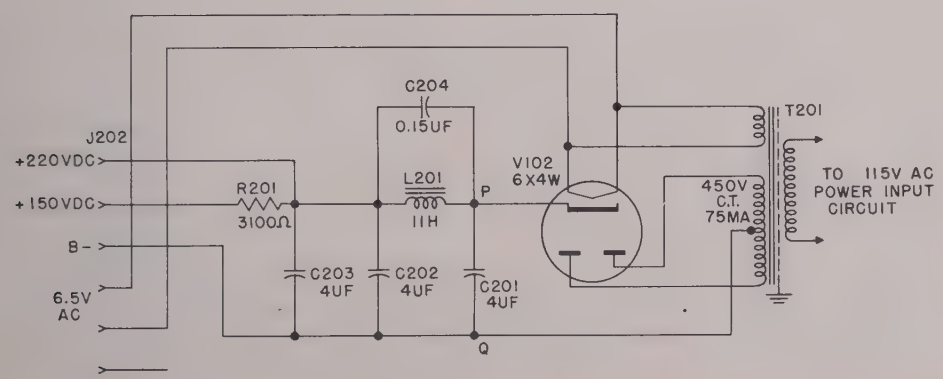


Figure 2–12. Power Supply PP-1205/URM-25E, Simplified Schematic Diagram

with r-f chokes L122 and L123 serves to filter any stray r-f from the power input lines.

l. Power Supply PP-1205/URM-25E. — (See figure 2—12)

The power supply, which is an integral part of the RF Signal Generator Set AN/URM-25E, consists essentially of a power transformer (T201) and a type 6X4W rectifier tube arranged in a full-wave rectifier type circuit with a PI filter network in the output. This unit functions to provide all the B+ and filament operating voltages required by the RF Signal Generator Set. Its operation is similar to that of any conventional full-wave rectifier type power supply. The rectified output along with the 6.5 volt filament supply is available at jack J202 in amplitudes of 150 and 220 volts d-c. The 150-volt output is obtained by using dropping resistor (R201) in series with the output. The PI filtering network consisting of choke L201, and capacitors C201, C202, and C203 provides output ripple filtering. Capacitor C204 is used in conjunction with L201 to form a 120-cycle resonant filter to lower the power supply hum level. To eliminate RF leakage into the power supply as a result of ground voltage gradients, the B-side of the power supply is carried to an external ground point in the audio compartment of the RF Signal Generator Set.

m. Voltage Regulator. — (See figure 2—13)

The voltage regulator circuit consists simply of a type OA2WA voltage regulator tube (V108) and a CARRIER CONTROL (R173), mounted on the modulation oscillator chassis in the audio compartment of the RF Signal Generator Set. It is used in conjunction with the power supply unit PP-1205/URM-25E to provide the required regulated d-c operating voltages for the RF oscillator tube (V101) and output amplifier tube (V103).

Voltage regulation is accomplished by connecting the regulator tube (V108) across the 150-volt d-c output of the power supply. Operation of the voltage regulator tube is relatively simple. As the voltage across the tube tends to increase, the internal resistance of the tube decreases; thus more current is drawn through the dropping resistor (R201) of the power supply, and the voltage across the tube is maintained at a constant level. Conversely, if the voltage across the tube tends to decrease, the internal resistance increases, less current is drawn through R201, and again the voltage across the tube remains constant. This voltage regulating ability of V108 also holds the output voltage stable when the load impedance varies. An increase in the load causes more current to flow through R201. This tends to decrease the output voltage appearing across the tube. However, deionization of the gas in the tube which results from the voltage drop tendency increases its internal impedance. This relative increase in V108 impedance with respect to the impedance of the series dropping resistor, again results in a tendency to raise the output voltage. Consequently, the output voltage level remains essentially constant for a fairly wide range of current (5 to 30 ma) through the tube.

The CARRIER CONTROL (R173), which is a linear potentiometer, provides a means of varying the regulated voltage applied to the plate of V101 in the RF oscillator stage to adjust the carrier amplitude.

3. SIGNAL GENERATOR TERMINATION.

The termination principles herein discussed are based on the assumption that this equipment will be used mainly with loads that are essentially resistive in nature. In cases where the load is not resistive, it will be necessary for the technician to interpret these principles with respect to the nature of the load. At frequencies below one megacycle, the length of the CG-409/U (48″) coaxial r-f output cable (W106), used with the AN/URM-25E, is only a very small fraction of the wavelength of the r-f signal and hence it has little effect on the output voltage and, therefore, offers no termination problem. However, at frequencies above one megacycle the length of W106 becomes increasingly more important as it becomes a greater part of the wavelength. Hence, unless this cable is properly terminated in 50-ohms, it will introduce serious errors in the indicated voltage of M101, which is calibrated with respect to a properly terminated load. No termination of the signal generator end of the cable is required since its characteristic impedance of 50-ohms is the same as the output impedance at J102.

When the RF Signal Generator is used with a receiver whose impedance is greater than 500-ohms, the Impedance Matching Network CU-411/URM-25E (See figure 2—14) is inserted between the receiver and the end of W106. It is apparent from figure 2—15 that the voltage appearing across this unit, which consists essentially of resistor R-501, at points O and P will be one-half the open circuit voltage across the generator output at J102,

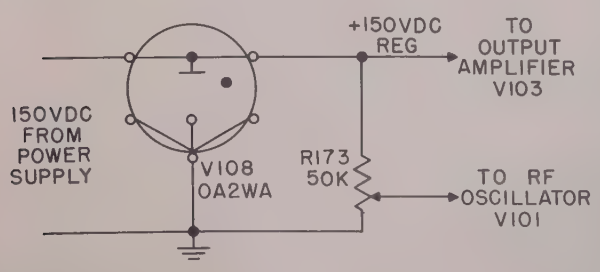


Figure 2—13. Voltage Regulator, Schematic Diagram

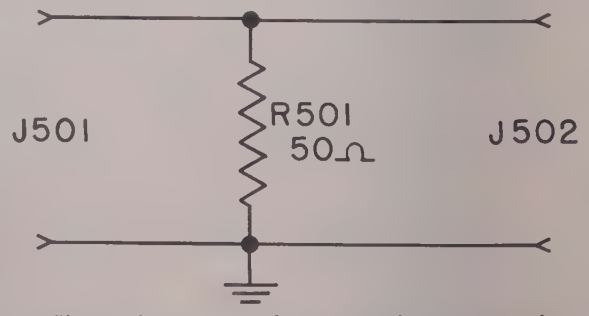


Figure 2—14. Impedance Matching Network CU-411/URM-25E, Schematic Diagram

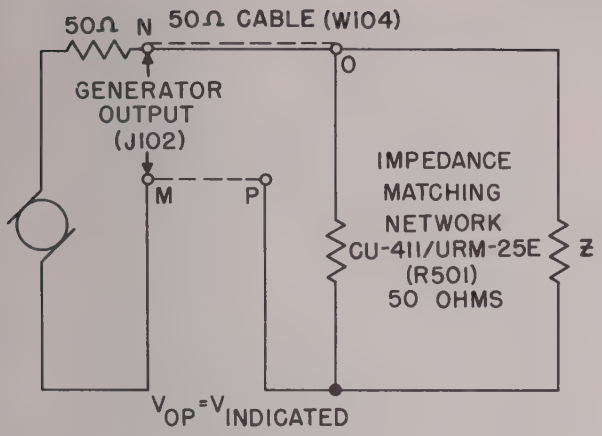


Figure 2—15. Equivalent Circuit of RF Output X-MULT (J102) With Impedance Matching Network CU-411/URM-25E

represented by points "MN". However, since the meter (M101) was calibrated with respect to a correctly terminated load, the reading on the meter will actually reflect the input voltage to the receiver under test.

The Impedance Matching Network CU-410/URM-25E (see figure 2—16) is used in similar fashion to the CU-411/URM-25E when testing 70-ohm receivers. The equivalent impedance of this Impedance Matching Network and the load will equal 50-ohms.

When the load impedance is less than 50-ohms, the impedance adapters cannot be used. In this case, a non-inductive composition resistor is added in series with the input element at the receiver under test, so that the sum of the receiver input impedance and this resistor will be 50-ohms (figure 2—17). The total load impedance then matches the signal generator impedance at J102 and standing waves are minimized. The actual receiver input voltage can then be calculated from the formula indicated in figure 2—17. When applying this procedure, it is often necessary to file down a smaller standard resistor to get the precise value required. The Resistance Bridge ZM-4/U or equivalent is used to measure the resistance. For example, if the load impedance of the receiver (Z) is equal to 30-ohms, a series resistor (R) of 20-ohms is added in series with the receiver. A meter (M101) indi-

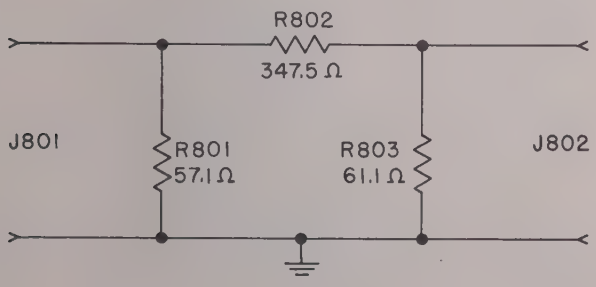


Figure 2—16. Impedance Matching Network CU-410/URM-25E, Schematic Diagram

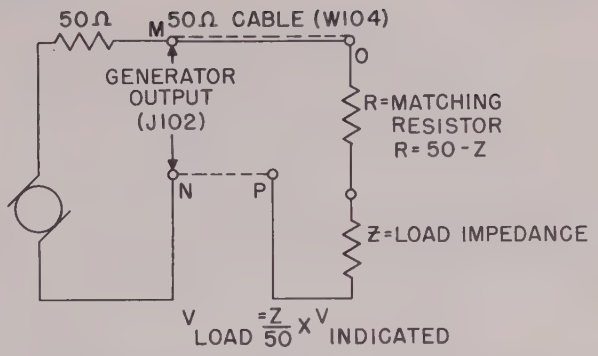


Figure 2—17. Equivalent Circuit of RF OUTPUT X-MULT (J102) with Series Matching Resistor Added

cation of 10,000 microvolts then represents an actual receiver input as follows:

$$E \text{ load} = \frac{Z}{50} \times M = \frac{30}{50} \times 10{,}000 = 6000 \text{ microvolts}$$

To minimize leakage and other losses, this series resistance is inserted as closely as possible to the input element of the receiver or instrument under test.

For lead impedances other than 70-ohms between 50-ohms and 500-ohms, non-inductive composition resistors are used to shunt the load (see figure 2—18). The equivalent impedance of the shunt and load then equals the generator output impedance of 50-ohms at J102. For example, if the receiver input impedance (Z) is 120-ohms, the correct shunt resistor (R) is selected as follows:

$$R = \frac{50 \times Z}{Z - 50} = \frac{50 \times 120}{120 - 50} = \frac{6000}{70} = 85.07 \text{ ohms}$$

It is apparent that the meter (M101) indication will be the same as the actual input voltage to the receiver. For accurate voltage indication, a standard resistor is filed down until the desired value is obtained. The Resistance Bridge ZM-4/U or equivalent is used to determine when this value is reached.

Note that the above termination methods apply only when taking the output from J102. The impedance at the RF OUTPUT X-200K jack (J101) is approximately 500-ohms shunted by the jack capacitance (approximately

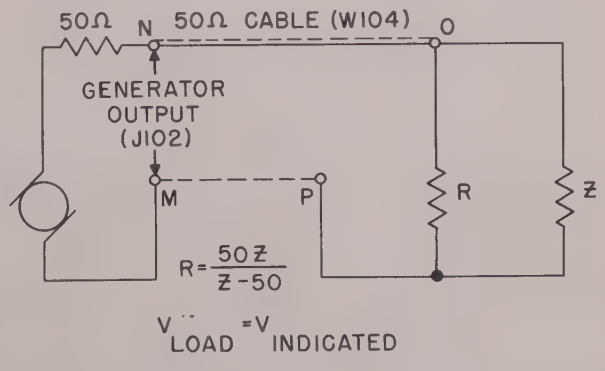


Figure 2—18. Equivalent Circuit of RF OUTPUT X-MULT (J102) with Shunt Resistor Added

4 mmf). Below 8 mc the shunt reactance of this jack has no appreciable effect on the voltage obtainable from J101. At 40 mc, however, the reactance due to the shunt capacitance is approximately 1000 ohms, and a 30% attenuation of signal voltage will be present at this frequency. In any event, a minimum of 2-volts across a high impedance load is available at J101 for all frequencies. When J101 is used, the output voltage in microvolts is determined by multiplying the meter (M101) reading by 200,000. This will be the actual voltage across a high-impedance load.

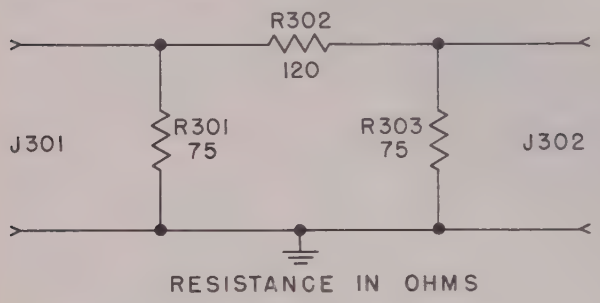


Figure 2—19. Fixed Attenuator CN-284/U, Schematic Diagram

4. FIXED ATTENUATOR CN-284/U (5:1)
(See figure 2—19)

This attenuator is designed to be used when the input impedance of the receiver under test is 50-ohms. It consists of three resistors (R301, R302, R303) connected in a pi-network to give an equivalent resistance of 50-ohms when properly terminated in 50-ohms. It can readily be calculated that the output terminal voltage of this attenuator unit will be one-fifth its input voltage when properly terminated in 50-ohms. It therefore follows that the voltage output from the fixed attenuator will be one-fifth the voltage indicated by M101. The 5:1 fixed attenuator is designed to be used in conjunction with the RF OUTPUT X-MULT jack (J102), never with the RF OUTPUT X-200K jack (J101). It is especially useful when using the meter (M101) at output levels below 2. This applies to microvolt ranges below 20,000 mv; 2,000 mv; 20 mv; 2 mv or 0.2 mv as selected by the R.F. MULTIPLIER control.

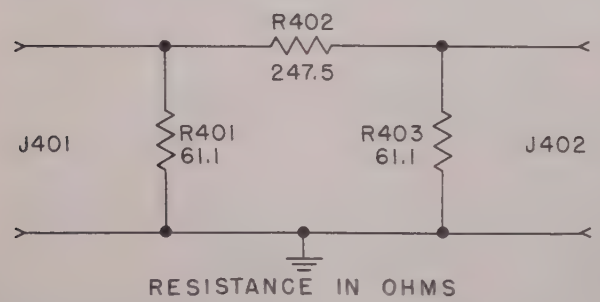


Figure 2—20. Fixed Attenuator CN-283/U, Schematic Diagram

5. FIXED ATTENUATOR CN-283/U (10:1)
(See figure 2—20)

This unit functions to provide a 10:1 attenuation of the J102 output when terminated in 50-ohms. It may be used for checking the positions of the step attenuator or for obtaining a high degree of voltage accuracy for low level outputs on the 30-50 mc band.

6. ELECTRICAL DUMMY LOAD DA-106/URM-25E
(See figure 2—21)

The Electrical Dummy Load is intended for use with a receiver designed to be utilized with a standard antenna. It serves to approximate the conditions that would exist if the signal was applied to the antenna circuit of the receiver. At frequencies above approximately 2.5 megacycles, this unit acts like a pure resistance of from 220 to 400-ohms. Below 1.6 megacycles, it acts like a capacitance of 200-micromicrofarads in series with an inductance of 20-microhenries and a resistance of 15-ohms.

From the impedance curve (figure 2—21), it can be seen that the minimum impedance of the dummy load is approximately 220-ohms. This impedance becomes much higher at low frequencies and approaches 400-ohms at the higher frequencies. The actual impedance of this unit for any one frequency can be determined from figure 2—21. Because of the impedance of this unit, it must be used in conjunction with the Impedance Matching Network CU-411/URM-25E when the r-f output is taken from J102.

Since the dummy load approximates a standard antenna which is used when making overall sensitivity measurements of a receiver designed for use with it, the significant voltage is the input voltage to the dummy load and not the input voltage to the receiver. For accurate receiver output voltage indication, it should be realized that the total load impedance consisting of the impedance of the dummy load in series with that of the receiver under test must be at least 500-ohms. This is especially important at frequencies below 5 megacycles where the dummy load impedance falls off to approximately 220-ohms.

7. TEST LEAD CX-2962/U.
(See figure 2—22)

The Test Lead CX-2962/U, consisting of the parallel combination of capacitors C601 and C602 in series with two clip leads, is used for making interstage receiver measurements. The capacitor network is inserted to protect the step attenuator (AT101) of the signal generator from accidental test probing at points of B+ potential. The reactance of the capacitors should not normally affect the accuracy of the meter (M101) voltage indication since, in most cases, the impedance at receiver interstage measurement points will be high. It must be realized, however, that when the test lead is used to test points of low impedance (below 400-ohms) the meter indication can no longer be depended upon to reflect the actual signal voltage applied.

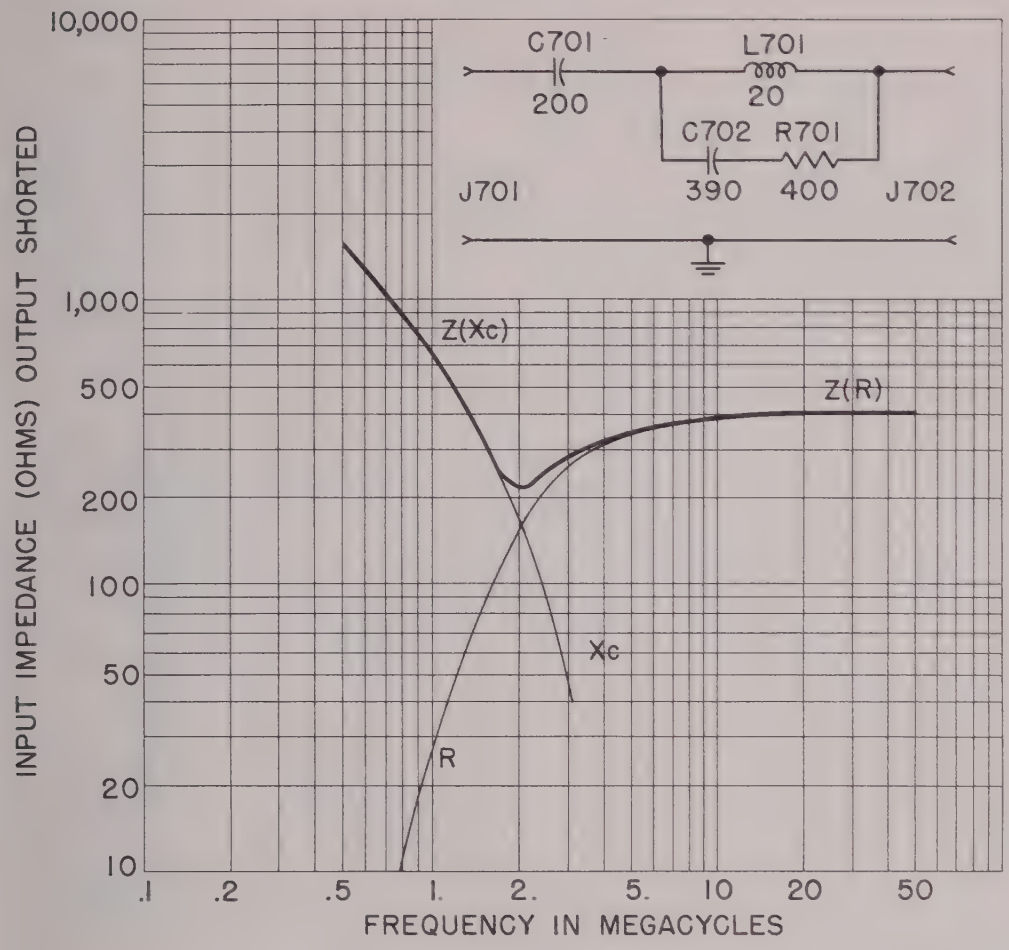


Figure 2—21. Schematic Diagram of Electrical Dummy Load DA-106/URM-25E With Input Impedance Frequency Curve

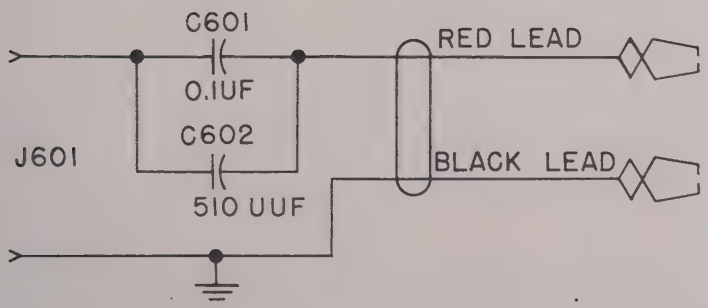


Figure 2—22. Test Lead CX-2962/U, Schematic Diagram

SECTION 3
INSTALLATION

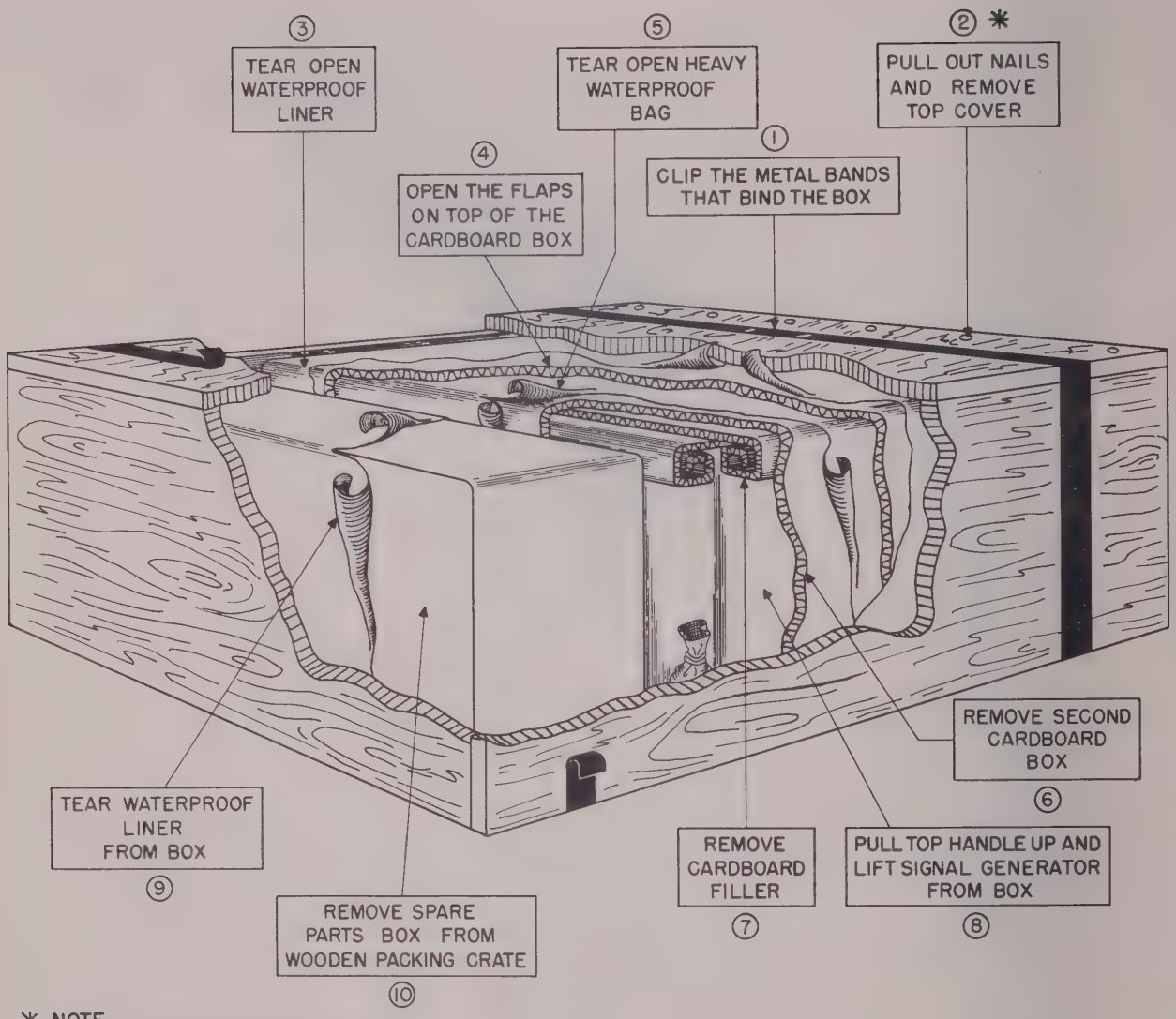

③
TEAR OPEN WATERPROOF LINER
⑤
TEAR OPEN HEAVY WATERPROOF BAG
② *
PULL OUT NAILS AND REMOVE TOP COVER
④
OPEN THE FLAPS ON TOP OF THE CARDBOARD BOX
①
CLIP THE METAL BANDS THAT BIND THE BOX
REMOVE SECOND CARDBOARD BOX
⑥
TEAR WATERPROOF LINER FROM BOX
⑨
REMOVE CARDBOARD FILLER
⑦
PULL TOP HANDLE UP AND LIFT SIGNAL GENERATOR FROM BOX
⑧
REMOVE SPARE PARTS BOX FROM WOODEN PACKING CRATE
⑩
* NOTE
WHERE FIBER BOARD CONTAINER IS USED
OPEN THE FLAPS ON THE TOP OF THE BOX

Figure 3—1. RF Signal Generator Set AN/URM-25E, Packaging Diagram

1. UNPACKING.

When packaged for overseas shipment or for domestic commerical shipment and storage, the AN URM-25E is placed in moisture-vapor proof containers and packed in fiber board boxes together with a set of equipment spares. A typical equipment packaged and packed for overseas shipment or for domestic shipment and storage is shown in figure 3—1.

Note

Depending upon the supply channels involved, some variations of the packaging and packing method may occur in some instances.

To remove the equipment from the shipping containers, follow the step by step unpacking procedure in figure 3—1. Exercise great care not to damage the equipment.

2. INSTALLATION.

The AN/URM-25E is a portable signal generator and does not require permanent installation.

The equipment is intended to be operated with the panel in the vertical position. Rubber supporting feet are provided for the cabinet. These feet protect the finished surface and serve to insulate the cabinet from a grounded desk. This insulation precaution, however, is not normally required.

The following preliminary settings and checks are required prior to placing the equipment in operation (Figure 4–1).

a. Turn POWER switch (S103) to OFF position.

b. Turn Carrier control (E114) and AUDIO OUTPUT control (E115) to the fully counterclockwise positions.

c. Insert the plug (P110) on the end of power cable W109 into the 115 volt AC power source.

3. ADJUSTMENTS.

All operating adjustments are described in Section 4 – OPERATION.

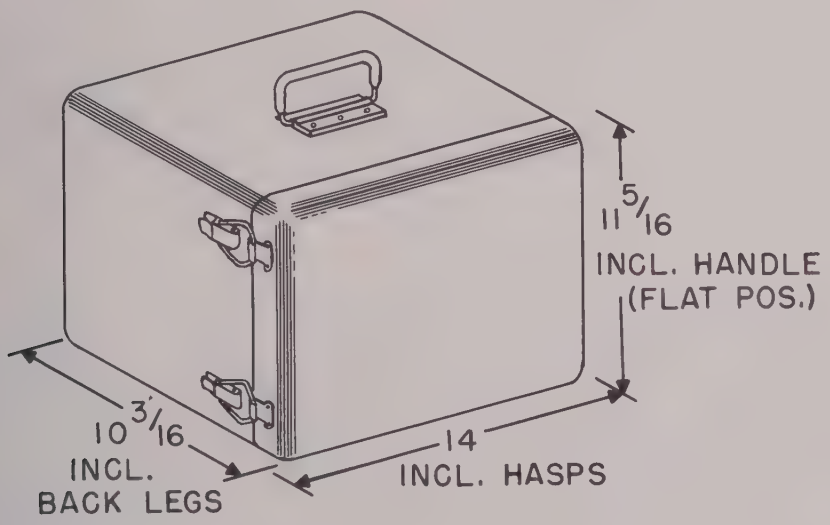


Figure 3–2. RF Signal Generator Set AN/URM-25E, Outline Dimensional Drawing

SECTION 4
OPERATION

1. GENERAL.

It is the purpose of the OPERATION section to instruct personnel in the proper use of the AN/URM-25E as a test instrument. To be thoroughly familiar with the method of operation, it is suggested that both Section 2 THEORY OF OPERATION and this section be carefully read and studied.

In the development of this section, an attempt has been made to present each step in the logical sequence necessary to place the equipment in operation. If these steps are carefully adhered to, the operator will not only avoid damaging the signal generator, but will be assured of a correct interpretation of the data as prescribed by the instrument. Table 4—1 is an operational summary of all front panel controls.

The essential details of operation and the necessary precautions to be taken are covered in this section under the following headings and paragraphs:

a. Starting Procedure ..... Par. 2
b. Checking the Meter Zero ..... Par. 3
c. Operation as a C-W Signal Generator ..... Par. 4
d. Operation as an A-M /Audio Signal Generator ..... Par. 5
e. Coupling to the Receiver under Test ..... Par. 6
f. Use of Electrical Dummy Load DA-106. URM-25E ..... Par. 7
g. Use of (5:1)Fixed Attenuator CN-284/U Par. 8
h. Use of (10:1) Fixed Attenuator CN-283/U Par. 9
i. Summary of Operation ... . Par. 10
j. Signal Testing Techniques ..... Par. 11

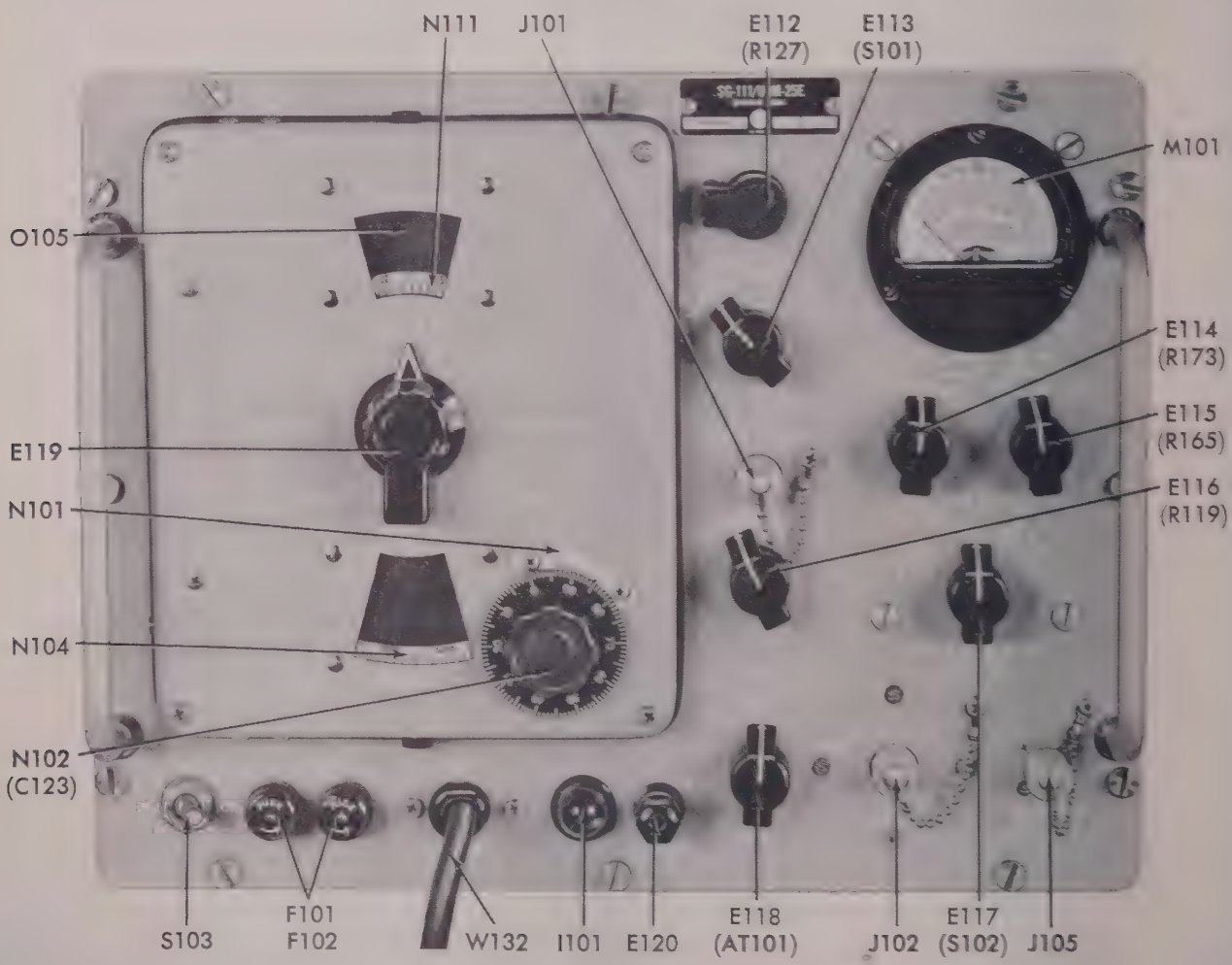


Figure 4—1. RF Signal Generator SG-111/URM-25E, Front Panel Controls and Devices

Note

All reference to symbol designations in this section apply to the front panel diagram Figure 4–1 unless otherwise noted. Primary reference is made to the symbol designation of the front panel knob (e.g. E114) applicable to the specific circuit element (e.g. R173). The association between the knob and circuit part is shown on Figure 4–1 by indicating the corresponding circuit element designation following the knob symbol (e.g. E114 (R173)).

2. STARTING PROCEDURE.

a. Turn the carrier control (E114) and the % MOD AUDIO OUT XTAL CAL OUT knobs (E115) fully counterclockwise.

b. Insert the connector plug (P110) on the end of the a-c input power cable (W109) into a 115-volt, 50 to 1000-cycle, a-c source.

c. Throw the POWER switch (S103) to the ON position and allow the signal generator to warm-up for approximately 15 minutes before using. This period permits the instrument to reach a stable operating state.

TABLE 4–1. FUNCTIONS OF FRONT PANEL CONTROLS, INDICATORS AND CONNECTORS

SYMBOL	PANEL DEVICE	FUNCTION
E113	Carrier range switch.	*a.* Selects output voltage source for the 10 to 300 kc or 300 kc to 50 mc carrier range.
E114	Carrier control.	Regulates level of carrier.
E115	% MOD, AUDIO OUT, XTAL CAL OUT.	*a.* Adjusts modulation percentage for internal and external modulation. *b.* Adjusts output level of internally generated 400 or 1000 cps signal. *c.* Adjusts level of crystal beat note at XTAL CAL OUT jack.
E116	MICROVOLTS Control.	Adjusts output level of signal generator.
E117	MOD-XTAL & METER SELECTOR.	*a.* Selects one of the following modes of operation: CW, External modulation, Internal modulation 400 cps, Internal modulation 1000 cps. A fifth position, XTAL, is used for accurate frequency calibration with integral crystal. *b.* Switches meter for reading carrier output in XTAL and CW positions; for reading % modulation in EXT., 400 cps and 1000 cps.
E118	RF MULTIPLIER switch.	Selects desired RF output level, which is the product of meter reading and RF MULTIPLIER Factor.
E119	Frequency Band Switch.	Selects desired frequency band.
E120	Ground terminal.	Used when necessary for orienting ground with equipment under test.
F101	Fuse (one-amp).	Protect power circuit.
F102	Fuse (one-amp).	Protect power circuit.
I101	Pilot Lamp.	Lights when generator set is operating.
J101	RF OUTPUT X-200K jack.	Approximately 500-ohm, two volt open circuit RF output.
J102	RF OUTPUT X-MULT jack.	50-ohm step attenuator output.
J105	EXT MOD IN—AUDIO OUT—XTAL CAL OUT jack.	*a.* Input for external modulation signal. *b.* Output for internally generated audio signals. *c.* Output for crystal beat note (headset).
M101	Meter.	Indicates microvolts output (upper scale), and percentage of modulation (lower scale).
N101	Tuning dial vernier scale.	Permits frequency interpolation of tuning dial.
N102	Main tuning control and dial.	Selects desired frequency within each band.
N104	Frequency scale dial indicator.	Indexes frequency scale.
N111	Frequency scale.	Indicates output frequency.
O105	Dial shutter.	Makes visible only frequency band selected.
R127	CARRIER METER ZERO control.	Screwdriver adjustment for zeroing carrier meter.
S103	POWER switch.	ON-OFF switch for application of power.
W109	AC line cable.	Provides a-c power connection.

The power ON-OFF indicator (I101) should light when the POWER switch is in the ON position.

3. CHECKING THE METER ZERO.

a. Having completed the starting procedure, move the MOD-XTAL & METER SELECTOR (E117) to the CW position. Meter M101 should read zero. If the meter does not read zero, turn the CARRIER METER ZERO control (R127) located under cover E112 until the proper indication is obtained.

4. OPERATION AS A C-W SIGNAL GENERATOR.

a. General.—Having placed the AN/URM-25E in operating condition in accordance with the preceding instructions, it may now be used as a C-W signal generator to produce an unmodulated C-W output signal by proceeding as follows:

(1) Turn the MOD XTAL & METER SELECTOR (E117) to the CW position.

(2) Set the carrier control (E114) in its maximum counterclockwise position.

(3) Set MICROVOLTS control (E116) fully clockwise.

(4) Set the output/carrier range switch (E113) in the X-MULT position for the frequency range to be used.

(5) Turn the frequency band switch (E119) to the position corresponding to the frequency band desired.

(6) Turn the main tuning control and dial (N102) until the desired frequency value on the frequency scale (N111) coincides with the hairline on the frequency scale dial indicator (N104).

Note

Where frequency value indications within an accuracy of ±0.05% are necessary, the above reading may be interpolated by utilizing the index scale of N111 in conjunction with the reading indicated by the tuning dial (N102) and the vernier scale (N101) (See paragraph 4.b.).

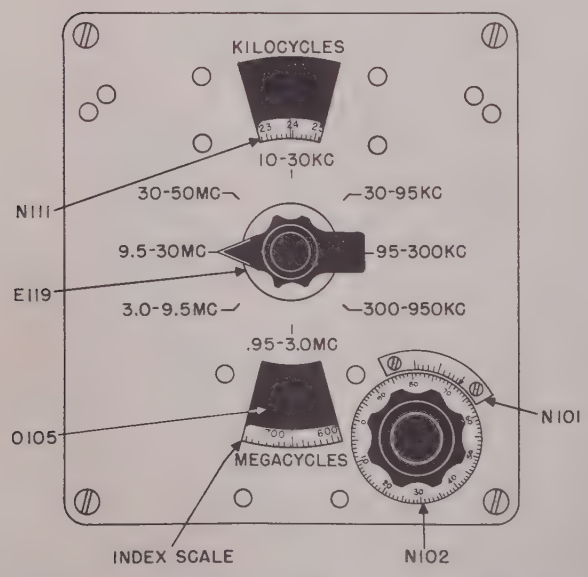


Figure 4–2. Diagram Showing Vernier Reading of Frequency Scale

(7) Adjust the output voltage by advancing the carrier control (E114) in a clockwise direction until the meter reads "10" on the upper scale. When using the RF OUTPUT X-MULT, select the attenuator range desired by means of the RF MULTIPLIER switch (E118) and adjust the MICROVOLTS control (E116) for the desired output voltage. This voltage is determined in microvolts by multiplying the meter reading by the multiplier position of E118 when the generator output is terminated in its characteristic 50-ohm impedance.

Note

When changing the frequency, readjust the carrier control (E114) for a meter reading of "10" with the MICROVOLTS control (E116) in the maximum clockwise position and adjust the MICROVOLTS control (E116) for the desired output voltage. Do not use the carrier control for this purpose.

(8) Cover all jacks not in use to prevent leakage.

b. Crystal Calibration. — When an r-f carrier frequency accuracy within ±0.05% is necessary for frequencies between 1 mc and 50 mc, proceed as follows:

(1) Set the signal generator to the approximate desired frequency (See paragraph 4.a. steps 1 thru 6).

(2) Set the MOD-XTAL & METER SELECTOR (E117) to the XTAL position.

(3) Connect a pair of earphones to the EXT MOD IN AUDIO OUT XTAL CAL OUT jack (J105).

(4) Set MICROVOLTS control (E116) fully clockwise.

(5) Adjust carrier control until meter reads "10" (full scale deflection).

(6) Select the nearest megacycle beats on either side of the desired signal and record the vernier dial (N101) readings at these points.

(7) Use audio output control (E115) as volume control, if necessary, to increase beat note audibility. Accurate frequency is found by the conventional interpolative method. (See example).

c. Example of Frequency Interpolation. — (See figure 4–2)

(1) Assume that it is necessary to obtain a signal at 24.2 mc ±0.05%.

(2) Select the zero beat closest to 24 mc. This might indicate a reading slightly less than "670" on the index scale. From figure 4–2 we see that the arrow on N101 points to somewhere between "68" and "69". We also see from this figure that the fifth line on N101 lines up with a marker on N102. The numerical setting at this crystal check point is therefore "668.5".

(3) Rotate the tuning dial N102 clockwise, passing the 24 mc marking, until the next zero beat is heard. This will appear 1 mc away from the first check point. Let us assume that this will occur at a vernier reading at 704.1. This represents a vernier difference of 35.6 for a one mc spread. The setting for a frequency of 24.2 mc represents a change of 0.2 megacycle from the lower check point. Thus 0.2 X 35.6 dial divisions per megacycle = 7.12 dial divisions, add this to the vernier setting recorded for 24 mc (668.5). The vernier setting for 24.2 mc is then 675.6.

5. OPERATION AS AN A-M/AUDIO SIGNAL GENERATOR.

a. General. — This instrument may be used as an a-m signal generator to produce an r-f carrier amplitude modulated from 0 to 50% by utilizing either an internally generated 400/1000 cycle per second signal or an external 100 to 15,000 cycle per second signal source. The internally generated 400 or 1000 cycle per second signal, adjustable from 0 to approximately 3 volts, can also be used as an audio output. With the equipment in operating condition, the above functions can be accomplished by proceeding in accordance with the following:

b. Internal Modulation. —

(1) Select the carrier frequency desired and adjust its output level in accordance with paragraph 4.

(2) Place the % MOD AUDIO OUT XTAL CAL OUT control (E115) in its maximum counterclockwise position.

(3) Set the MOD XTAL & METER SELECTOR (E117) in the 400 or 1000 cycle position depending upon the modulation frequency desired.

(4) Adjust the % MOD AUDIO OUT XTAL CAL OUT control (E115) until the meter M101 indicates the desired percentage of modulation.

c. External Modulation. —

(1) Select the carrier frequency desired and adjust its output level in accordance with paragraph 4.

(2) Set the MOD XTAL & METER SELECTOR (E117) to the EXT position.

(3) Connect an external audio source to the EXT MOD IN AUDIO OUT XTAL CAL OUT jack (J105). Do not use modulation frequencies above 1,000 cycles for carrier frequencies below 300 kc.

(4) Adjust the % MOD AUDIO OUT XTAL CAL OUT control (E115) until the desired percentage of modulation is indicated on meter M101.

d. Audio Output (400 or 1000 cycles per second). —

(1) Follow procedure for internal modulation excepting for step (1). An audio voltage proportional to the reading of M101 will be available at the EXT MOD IN AUDIO OUT XTAL CAL OUT jack (J105). When the meter reads "50" approximately 3 volts across an output impedance of 15,000 ohms is available.

6. COUPLING TO THE RECEIVER UNDER TEST.

a. RF Output X-Mult Jack (J102). — For best results follow the termination methods outlined in Table 4—2 when coupling the receiver to the 50-ohm output J102.

Note

These methods apply to loads which are essentially resistive in nature. Where the load is not resistive, it will be necessary for the technician to interpret the principles discussed in section 2 paragraph 3 with respect to the nature of the load.

Use cables W104, W105 and W106 as necessary for making the required connections between units. Connector adapters UG-201/U and UG-273/U are provided for use in adapting the BNC type connectors on the signal generator cables to type N and UHF connectors, respectively, found on many receivers. When low RF levels are used, better results may be obtained if the ground connections are oriented. The front panel binding post (E120) is provided for this purpose.

b. RF OUTPUT X-200K jack (J101). — The impedance at this jack is a resistance of approximately 500 ohms shunted by the capacitance of the jack (approximately 4 mmf). Below 8 mc this jack shunt reactance has no appreciable effect on the voltage obtainable for J101. At 40 mc, however, the reactance due to the shunt capacitance is only 1000 ohms, and a 30% attenuation of signal voltage will be present at this frequency. In any event, a maximum 2 volts across a high impedance load should be available at J101 for all frequencies. It is reemphasized at this point that the termination methods outlined in Table 4—2 do not apply on this jack since the impedance at J101 is 500-ohms. When using the RF OUTPUT X-200K jack, the output voltage in microvolts is determined

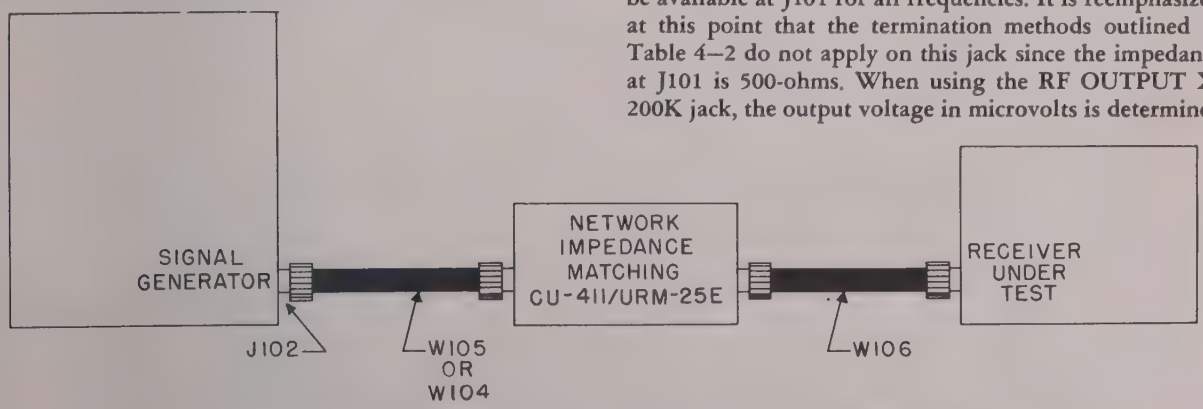


Figure 4—3. Method of Inserting Impedance Matching Network

by multiplying the meter M101 reading by 200,000. This will be the actual voltage across a high impedance load.

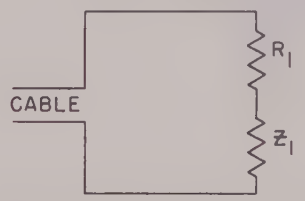
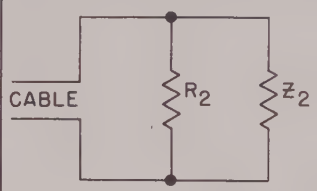
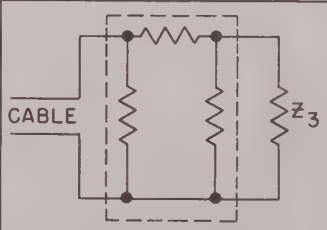
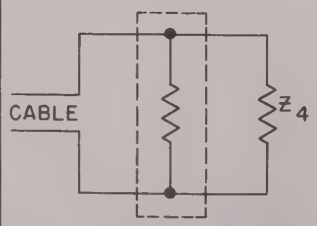
CAUTION

Care must be taken to prevent the introduction of voltages back into the attenuators or impedance adapters from the circuit under test. Currents greater than 20 milliamperes may burn out the resistances incorporated within these units. Always insert the Test Lead CX-2962/U whenever making point-to-point measurements in a receiver. This precaution is not necessary when using the dummy load, which contains a series capacitor.

7. USE OF ELECTRICAL DUMMY LOAD DA-106/URM-25E.

a. General — The Electrical Dummy Load DA-106/URM-25E is used when making overall measurements or tests on a receiver designed for use with a standard antenna. The dummy load merely approximates the conditions that would exist had the signal been applied to the antenna circuit of the receiver and, therefore, the significant voltage is the input voltage to the dummy load and not the input voltage to the receiver. When using the dummy load, connect the r-f output cable (W106) to the RF OUTPUT X-MULT jack (J102) and terminate this cable with the Impedance Matching Network CU-411/URM-25E. Use r-f output cable (W105) for the connection between the dummy load and the

TABLE 4-2. METHODS FOR CORRECTLY TERMINATING THE SIGNAL GENERATOR AT J102.

TYPE OF INPUT	LOAD IMPEDANCE	CIRCUIT	ACCESSORY	VOLTAGE APPLIED TO LOAD IS:
I	Z_1 LESS THAN 50 OHMS		$R_1 = 50 - Z_1$ WHERE R_1 = NON INDUCTIVE SERIES RESISTOR	$V_{INDICATED} \times \frac{Z_1}{50}$
II	Z_2 FROM 50 OHMS TO APPROX 500 OHMS (EXCEPTING 70 OHMS)		$R = \frac{50\ Z_2}{Z_2 - 50}$ WHERE R_2 = NON-INDUCTIVE SHUNT RESISTOR	$V_{INDICATED}$
III	Z_3 70 OHMS	 CU-410/URM-25E	IMPEDANCE MATCHING NETWORK CU-410/URM-25E (SEE NOTE)	$V_{INDICATED} \times .1$
IV	Z_4 500 OHMS OR MORE	 CU-411/URM-25E	IMPEDANCE MATCHING NETWORK CU-411/URM-25E	$V_{INDICATED}$

NOTE:
THE 50 OHM SIDE OF THE IMPEDANCE MATCHING NETWORK CU-410/URM-25E IS ON THE LEFT WHEN VIEWING THE NOMENCLATURE ON ITS COVER FROM A READING POSITION.

impedance matching network unit and the accessory cable W104 for the connections betwen the dummy load and the receiver under test.

Note

The minimum impedance of the dummy load will be approximately 220 ohms at 2 megacycles. This impedance becomes much higher at lower frequencies and approaches 400 ohms at the higher frequencies. Consequently when using the meter (M101), it should be realized that a 20 per cent maximum error may be introduced at 2 megacycles. If greater voltage indication accuracy is required, the actual impedance of this unit should be determined from figure 4—4. Figure 4—4 in this section is the same as figure 2—21 in section 2 but has been repeated here to assist the operator in applying the procedure herein outlined for use of the dummy load.

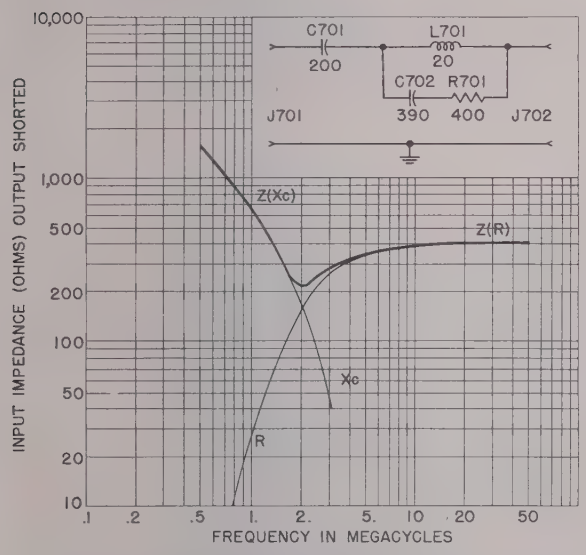


Figure 4—4. Input Impedance Frequency Curve of Electrical Dummy Load DA-106/URM-25E

8. USE OF (5:1) FIXED ATTENUATOR CN-284/U.

The (5:1) Fixed Attenuator CN-284/U attenuates the output at J102 in a ratio of 5:1 when terminated in 50-ohms. It is very useful when using the meter M101 at output levels below "2" where the instrument accuracy falls off. This applies to microvolt ranges below 20,000 mv, 2000 mv, 20 mv, 2 mv or 0.2 mv as selected by the RF MULTIPLIER knob (E118) and MICROVOLTS control (E116). In these cases, insert the (5:1) fixed attenuator at the RF OUTPUT X-MULT jack (J102) and terminate it as outlined in Table 4—2 for the required 50-ohms. The terminated output voltage is 1/5 the voltage indicated by M101. The actual load voltage, however, will be 1/5 the meter indication only when the load impedance is exactly 50-ohms or greater than 500-ohms. For example, if a signal generator output of 20,000 microvolts into a 600-ohm load is desired, insert the fixed attenuator as follows:

a. Connect the fixed attenuator to J102 using cable W106.

b. Terminate the (5:1) fixed attenuator with the Impedance Matching Network CU-411/URM-25E.

c. Set the RF MULTIPLIER knob (E118) to X1K.

d. Set MICROVOLTS control (E116) and carrier control (E114) for "10" meter reading.

e. The input to the load will be 20,000 microvolts.

If the load impedance is less than 50-ohms, it can be seen from Table 4—2 that the impedance matching network cannot be used, but the output from the (5:1) fixed attenuator must be fed to the load in series with the necessary resistor. The actual load voltage will then be something less than 1/5 the meter indication. For example, if a voltage of approximately 1200 microvolts with a load of 40-ohms is desired, insert a 10-ohm non-inductive resistor in series with the load and (5:1) fixed attenuator. The meter setting should be:

$$\text{v/meter} = \frac{50}{Z} \times M \times 5 = \frac{50}{40} \times 1200 \times 5 =$$

$150 \times 50 =$ approximately 7500 microvolts.

9. USE OF (10:1) FIXED ATTENUATOR CN-283/U.

The (10:1) Fixed Attenuator CN-283/U attenuates the output at J102 in a ratio 10:1 when terminated in 50-ohms. This unit should be used when a high degree of voltage accuracy is desired for low level outputs on 30-50 mc band. There is no need for using the 10:1 attenuator on other bands or steps higher than X.1 on the RF MULTIPLIER.

Example. — Selecting an accurate output of 0.8 microvolts at 30 mc into a load of 500-ohms or greater.

(a) Set signal generator frequency at 30 mc and RF MULTIPLIER (E118) at X1 range.

(b) Adjust MICROVOLTS control (E116) for reading of "8" on M101.

(c) Insert the 10:1 fixed attenuator at J102.

(d) Terminate 10:1 fixed attenuator with Impedance Matching Network CU-411/URM-25E.

(e) Feed the output from the Impedance Matching Network to the receiver under test.

(f) Input voltage to receiver is now 0.8 microvolts.

10. SUMMARY OF OPERATION.

In using the AN/URM-25E as a test oscillator, it will not always be necessary to apply all the procedures outlined in this section. The technician will determine by use, the precision requirements of the equipment under test. Figure 4—5 is a simplified procedure summary for the operation of the signal generator. An operational summary of the front panel controls is given in Table 4—1.

11. SIGNAL TESTING TECHNIQUES.

a. Details. — For additional details of proper signal testing techniques, the technician is referred to the Handbook of Test Methods and Practices NAVSHIPS

91828(A), basic equipment instruction book and also standard commercial texts. However, since most commercial test procedures refer to original broadcast type receivers which differ in principle and test values from standard Naval equipments, certain details of Naval values and methods are included herein.

CAUTION

Always use the Test Lead CX-2962/U when making point-to-point tests on a receiver. Failure to do so may result in burning out a resistor in the step attenuator (AT101) or in one of the accessory units.

b. Receiver Tests. –

(1) General. – The presence of incidental frequency modulation in an AM signal generator may introduce asymmetry in the apparent selectivity curve of the receiver being tested. This is particularly true for a very sharply-tuned circuit. The effects of frequency modulation have been kept at a minimum in the RF Signal Generator Set AN/URM-25E and should introduce no problem in receiver testing. For best results, however, the technician should perform all of the receiver tests (except audio response) by using the unmodulated carrier signal. In order to eliminate the need for modulation, insert a high impedance DC voltmeter such as Multimeter ME-25/U or equal across the load of the second detector of the receiver. Adjustments can then be made with the meter response giving the necessary indication.

(2) Sensitivity. – At high radio frequencies antenna characteristics cannot be easily reproduced, and considerable care must be taken in making receiver sensitivity tests. The voltage available at the signal generator unit output jack (J102) is always known, but it is not known at the receiver input terminals a few feet away. This latter voltage is proportional to the signal generator output voltage, but it may be larger or smaller due to the characteristics and the termination of the "transmission line" between the instruments.

(3) Selectivity. – The selectivity of a radio receiver is that characteristic which determines the extent to which the receiver is capable of distinguishing between the desired signal and disturbances of other frequencies. Selectivity is expressed in the form of a curve that gives the signal strength to produce a given receiver output at

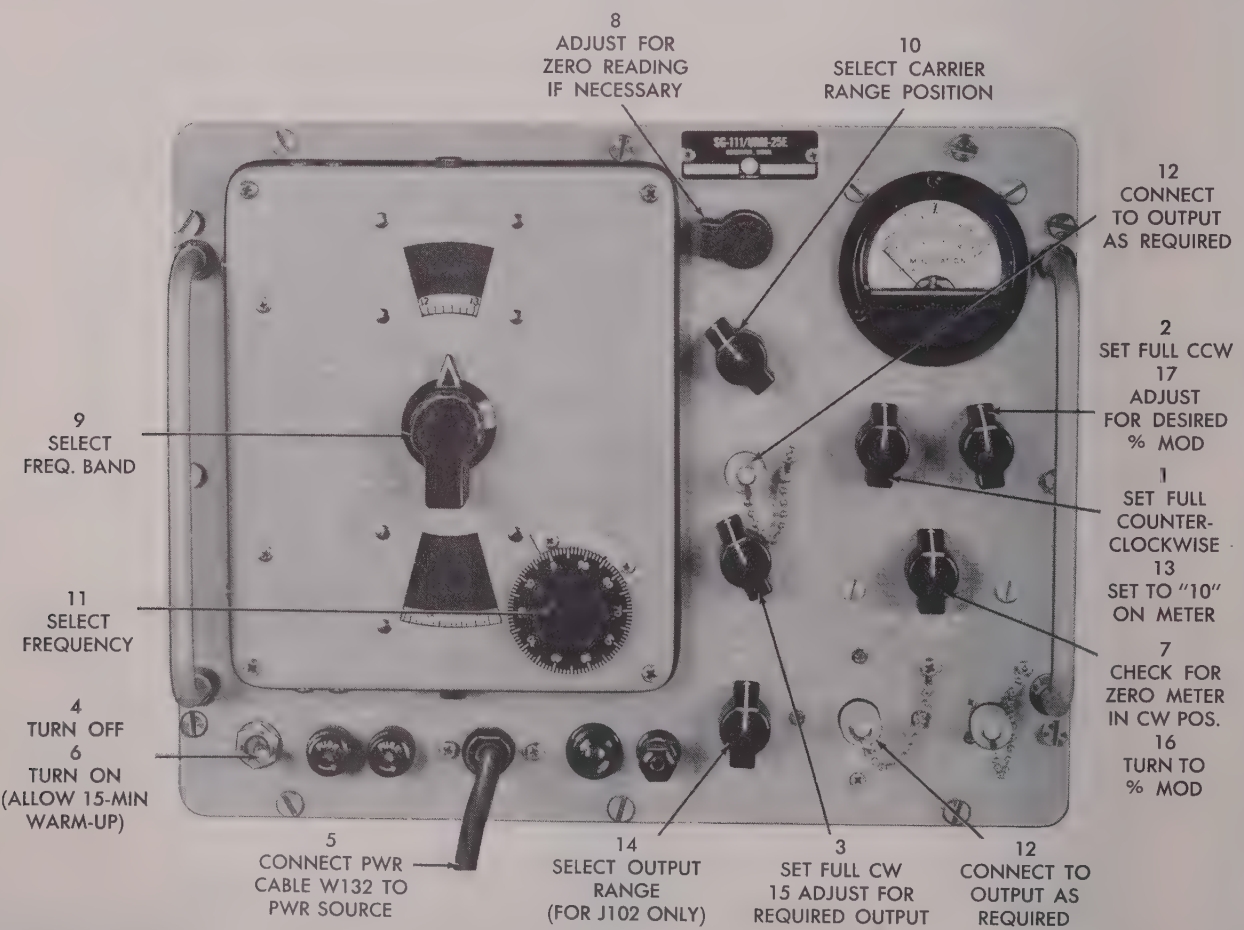


Figure 4–5. Simplified Operating Procedure for the RF Signal Generator Set AN/URM-25E

various frequencies, with the response at resonance taken as the reference. This selectivity curve is normally obtained by disabling the automatic volume control system of the receiver, setting the signal generator to the desired frequency, tuning the receiver to this frequency and modulating the carrier signal 30 per cent at 400-cycles. The carrier frequency output of the signal is then varied in steps from the frequency to which the receiver is tuned, adjusting the signal generator voltage as necessary to maintain a controlled receiver output. The unmodulated carrier method as described in paragraph 11b(1) of this section can also be used. Unless otherwise specified, the normal output is usually taken as 6 milliwatts into 600-ohms.

(4) Audio Response. — The audio response of a receiver shows the manner in which the electrical output at a dummy load depends upon the modulation frequency. In making this test connect an audio oscillator, such as the Navy Model LAJ Series, to the EXT MOD IN jack (J105). Set the MOD XTAL & METER SELECTOR knob (E117) to EXT position. Set the signal generator to the desired carrier frequency and tune the receiver under test to the signal. Adjust the signal generator until a convenient output is obtained. Observe the variaion in receiver output as the modulation frequency of the signal generator is varied from 400 cycles, while keeping the degree of modulation constant at 30 per cent. The results of an audio response test are expressed in the form of a curve with the ratio of actual output to 400 cycles output plotted vertically, and each corresponding audio frequency plotted horizontally. In making this test, care must be taken to avoid applying so great a signal to the receiver as to overload the output. In the event that the noise and hum level in the receiver output is appreciable it will be necessary to supply a strong enough signal from the generator to override this interfering effect.

(5) Measuring Receiver Gain per Stage. — The RF Signal Generator Set AN/URM-25E is also a useful device for measuring the gain of any particular receiver stage. This is accomplished by applying a signal to the input and output points of the stage in question and recording the signal voltage required, in either case, to give the same receiver output. The gain in db is then calculated by applying the formula:

$$\text{GAIN (db)} = 20 \text{ lg } \frac{\text{Vout.}}{\text{Vin}}$$

(6) Receiver Alignment. — The alignment of the intermediate frequency amplifier system of a simple receiver is usually carried out by setting up the signal generator at the proper frequency and working step by step backward through IF circuits from the second detector to the first detector.

CAUTION

Consult the particular receiver's instruction book for details of the method applicable to that receiver. This is particularly important for wide band rf amplifiers where over coupled, regenerative or stagger tuning is used. Be sure the aligning frequency is correct. Check with a heterodyne frequency meter such as Navy Model LM, AN/URM-82 or AN/USM-29 series to obtain greater frequency accuracy than obtainable with the signal generator below 1 mc. Above 1 mc, the crystal calibrator in the AN/URM-25E can be used to obtain an accuracy within 0.05%.

Always apply the signal generator to the grid immediately preceding the circuit under adjustment and adjust the trimmers (or variable inductances) for maximum output. In carrying out this procedure, it will of course be necessary to reduce the output of the signal generator each time the signal is applied to the grid of a tube at lower power level. The next step is to align the radio frequency and oscillator circuits of the receiver. This is accomplished by setting the receiver dial near the high end of the band in question and applying a signal of the proper frequency from the generator to the antenna input terminals of the receiver. First adjust the r-f stage shunt trimmer capacitors (or iron core inductances) for maximum receiver output, and then adjust the oscillator shunt trimmer until the receiver output is maximum. The receiver dial and signal generaor are then set at the low frequency end of the receiver dial, and the oscillator series padder capacitor is adjusted for maximum output. Recheck the high frequency end of the band and repeat the above procedure as necessary.

(7) Receiver Alignment above 50 megacycles. — The RF Signal Generator Set AN/URM-25E can also be used for aligning receivers above 50 mc using the second harmonic of the frequency selected. Although harmonic distortion has been kept below 10%, this still allows some second harmonics to be introduced at the RF OUTPUT X-MULT jack (J102). It must be realized that when the second harmonic is used, the signal generator meter can no longer be used as an indication of output.

c. Modulated Operation. — In using the equipment with modulated output, it should be realized that three waves are emitted, one at the carrier frequency and at two "side bands." While either pure or modulated CW signals can be obtained from the signal generator, considerable discretion must be used in employing the modulated method of receiver testing, based on the selectivity of the receiver and the frequency of test, since the carrier and both side bands must be received in true proportion in order to obtain accurate measurements.

d. Receiver Output. — In aligning or testing a receiver, a volt meter or output meter should be connected across the output terminals, in parallel with the proper resistance output load.

e. Receiver Overall Sensitivity. — Some radio receivers have an excess of sensitivity, such that at certain frequencies if the sensitivity, volume or gain control are advanced too far the inherent noise level is sufficient to saturate the detector or audio tubes. Accordingly, all receivers are measured and rated for both CW and MCW sensitivity on the basis of the sensitivity, volume, or

gain control being adjusted so that not more than 60 microwatts of noise is present in the output with no input signal impressed. When measuring receiver overall sensitivities obtainable on the first step of the attenuator, it should be remembered that the output of the signal generator may not be attenuated equally at all frequencies to an absolute value of zero when the RF MULTIPLIER knob (E118) is set at X.1 and the MICROVOLTS control (E116) is set fully counterclockwise. The effects of stray or leakage disturbances caused by circulating currents in the case, or between panel and case, may be minimized by properly orienting the signal generator and using the (10:1) Fixed Attenuator CN-283/U. (See Section 4, para. 9). Proper orientation of the generator with respect to the receiver will also limit the presence of undesired stray voltages. These stray effects can be ascertained by comparing the output of the receiver with the signal generator turned ON and OFF.

f. Standard Antenna Electrical Constants. — A standard antenna at low frequencies (below 1600 kilocycles) has essentially the same impedances as a series circuit of 20 microhenries, 200 micromicrofarads, and 15-ohms. The resonant frequency is about 2500 kilocycles. The high frequency impedance is approximately 400-ohms resistive. The Electrical Dummy Load DA-106/URM-25E closely approximates the standard antenna (See section 4, para. 7).

g. Standard Levels. — Standard levels are as follows:

(1) Standard output level of reference — 6 milliwatts.

(2) Standard noise level — 60 microwatts.

(3) Standard output load — 600-ohms for low impedance output, or 20,000-ohms for high impedance output unless, special impedances are provided in the receivers and noted in their instruction book.

h. Voltmeter Used as an Output Meter. — In making measurements when a voltmeter is used as an output meter, the following approximate wattages correspond to the voltages at the load impedances noted:

(1) 1.9 volts at 600-ohms 11.0 volts at 20,000-ohms	6 milliwatts
(2) 0.19 volts at 600-ohms 1.1 volts at 20,000-ohms	60 microwatts
(3) .77 volts at 600-ohms 4.5 volts at 20,000-ohms	1 milliwatt

(4) For receivers provided with output meters having a zero level of 6 milliwatts — minus 20 decibles equal 60 microwatts.

(5) For receivers provided with output meters having a zero level of 60 microwatts — plus 20 decibels equal to 6 milliwatts.

SECTION 5

PREVENTIVE MAINTENANCE

1. ROUTINE MAINTENANCE CHECK CHART.

The construction of the RF Signal Generator Set AN/URM-25E is such that preventive maintenance measures will be limited. Periodic testing of the equipment to determine if it is in proper working order should be performed in accordance with the step-by-step procedure given in Table 5—1 ROUTINE CHECK CHART. If the signal generator is used frequently (several times a week), these checks should be made prior to use. Otherwise they should be made weekly. All symbol designation given in Table 5—1 refer to Front Panel Diagram, Figure 4—1 in Section 4 OPERATION unless otherwise specified.

Note

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE BUREAU OF SHIPS MANUAL OF THE LATEST ISSUE.

2. FUSE FAILURE.

Symptoms of fuse failure and fuse location are given in Tables 5—2 and 5—3.

CAUTION

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than probable damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been corrected.

3. LUBRICATION.

All gears and moving shafts should be lubricated periodically with Aircraft and Instrument Grease per specification MIL-G-3278 SNSN W14-G-611-10 (1 lb.) or W14-G-611-5 (8 oz.).

TABLE 5–1. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS AND REMARKS
1. Installation	Before connecting the power cable (W109) to the power source, make sure the equipment is properly set up in accordance with instructions given in Section 3—INSTALLATION. *a.* POWER switch (S103) in OFF position. *b.* Carrier control (E114) fully counterclockwise. *c.* Audio output control (E115) fully counterclockwise. *d.* MICROVOLTS control (E116) fully clockwise.	See that all the cables and wires are in good condition and that electrical connections are properly made.
2. Power Supply	Set controls as follows: *a.* Carrier control (E114) fully counterclockwise. *b.* % MOD AUDIO OUT XTAL CAL OUT control (E115) fully counterclockwise. *c.* POWER switch (S103) to ON position.	The indicator lamp (I101) and frequency scale lamps (E121 and E122) should light. If they do not, check front panel fuses (see Table 5–3) and lamps.
3. Meter Check	*a.* Set carrier control (E114) fully counterclockwise. *b.* Throw POWER switch (S103) to ON position. *c.* Allow 15 minutes warm up period. *d.* Set MOD XTAL & METER SELECTOR knob (E117) to CARRIER position. *e.* Meter should read zero.	If the meter does not read zero with the MOD XTAL & METER SELECTOR in the CARRIER position, R127 requires adjustment. (See Section 4, figure 4–1.)
4. Carrier Frequency	Set controls and switches as follows: *a.* Carrier control (E114) to full counterclockwise position. *b.* MICROVOLTS control (E116) to full clockwise position. *c.* MOD XTAL & METER SELECTOR knob (E117) to CARRIER. *d.* Carrier range knob (E113) to corresponding range position. *e.* POWER switch (S103) to ON.	*a.* Meter (M101) should move up-scale as carrier control (E114) is rotated in a clockwise direction. *b.* Meter pointer should read "10" in all positions of the frequency band switch (E119), when the carrier control is advanced in a clockwise direction.
5. Modulation Frequency	Set controls and switches as follows: *a.* Carrier control (E114) fully counterclockwise. *b.* Audio output control (E115) fully counterclockwise. *c.* MOD XTAL & METER SELECTOR knob (E117) to 400 cycles. *d.* Carrier range knob (E113) to corresponding band position. *e.* POWER switch (S103) to ON.	*a.* When audio output control (E115) is rotated clockwise, the meter should reach at least 50% modulation.

TABLE 5—2. SYMPTOMS OF FUSE FAILURE

INDICATOR (I101) AND SCALE (E121 AND E122) LAMPS OF SIGNAL GENERATOR	ALL ELECTRON TUBES	METER M101	OPEN FUSE	VALUE (AMPS)	COMMENTS
None Light None Light	Filaments off Filaments off	No reading No reading	F101 F102	1 1	Check also power supply, cables, connectors, etc. and the POWER switch (S103).

TABLE 5—3. FUSE LOCATIONS

SYMBOLS	LOCATIONS	PROTECTS	AMPS	VOLTS
F101 & F102	1. Physically located in signal generator front panel fuseholders (XF101) and (XF102). See figure 4—1. 2. Electrically located in primary of power transformer T201. See figure 6—28.	Primary of power transformer	1.0	250

FAILURE REPORTS

"Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD 787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment nameplate), the type number of the major unit (from the major unit nameplate), and the type number and reference designation of the particular defective part (from the instruction book). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember—there are two sides to the failure report . . .

"YOUR SIDE"

Every FAILURE REPORT is a boost for you:
1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacements.
4. It gives you a chance to pass your knowledge to every man on the team.

"BUREAU SIDE"

The Bureau of Ships uses the information to:
1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest District Publications and Printing Office."

Figure 6—1. Failure Report

SECTION 6

CORRECTIVE MAINTENANCE

1. THEORY OF LOCALIZATION.

a. The first step in maintenance or repair is to determine definitely that a defective condition exists. If the equipment is not operated correctly, certain indications of trouble might be presented when there is actually nothing wrong with the equipment. The technician should be thoroughly familiar with Section 4, OPERATION, of this book before attempting to analyze the indicated defect.

b. After a positive determination is made that the generator is defective, the first step in trouble shooting is to localize the trouble, that is, decide which circuit of the complete system is not functioning as it should. Once the analysis has been narrowed down to the defective circuit, it becomes a relatively simple process of making voltage and resistance checks to locate the faulty circuit part (e.g. resistor, capacitor, etc.).

c. The chief parts of the signal generator which are subject to wear or deterioration are electronic tubes and switches. In addition the carrier oscillator inductances may vary slightly and require recalibration as a result of aging or excessive temperature variations. (See Table 6–1 – FREQUENCY CALIBRATION DATA).

2. TEST EQUIPMENT FOR MAKING REPAIRS AND TROUBLE SHOOTING.

The technician may find a wide variation of applicable test equipment to use in making repairs or for trouble shooting on the RF Signal Generator Set AN/URM-25E. However, to achieve the best results in accordance with the characteristic of the signal generator, the following test equipments or their equivalents are recommended for use:

a. Naval Model LM, AN/URM-82 or equivalent series Crystal Calibrated Frequency Indicating Equipment.

b. Navy Model AN/USM-29 Series or equivalent Combined Heterodyne Frequency Meter and Crystal Controlled Calibration Equipment.

c. Signal Generator TS-535/U.

d. Resistance Bridge ZM-4/U.

e. Electronic Multimeter AN/USM-34, ME-25/U Series or equivalent.

f. Oscilloscope OS-8/U or equivalent.

g. Multimeter AN/PSM-4, TS-352/U, Navy Model OE Series Receiver Analyzing Equipment.

h. Tube Tester TV-3/U series or equivalent.

i. Megohmmeter, Insulation Tester, AN/PSM-2.

3. SYSTEM TROUBLE SHOOTING.

a. In employing any systematic method for trouble shooting, the methods and procedures followed by the technician will vary greatly. Any method employed is satisfactory as long as it will produce accurate results with the greatest expediency.

b. To assist the electronics technician in applying himself to the maintenance problems of the RF Signal Generator Set AN/URM-25E, a trouble symptoms chart and two trouble shooting tables are listed in this section. The first, Table 6–2 – TROUBLE SYMPTOM CHART is a listing of some common trouble symptoms with suggested checks for locating the defect; the second, Table 6–3 – GENERAL TEST PROCEDURES FOR LOCALIZING TROUBLE, is a systematic procedure for determining the unit or component which is the source of trouble; the third, Table 6–4 – SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE gives some hints that may be applied in finding the specific part that may be defective.

4. TUBE OPERATING VOLTAGES AND CURRENTS.

Electron tube operating voltages and currents under normal operating conditions are given in Table 6–5 TUBE OPERATING VOLTAGES AND CURRENTS, located near the end of this section.

5. TUBE SOCKET ELECTRICAL MEASUREMENTS.

a. As a further aid in maintenance work, figure 6–15 SIGNAL GENERATOR VOLTAGE AND RESISTANCE CHART will be found near the end of this section. This chart lists diagrammatically the voltage and resistances measured from all tube socket connections to ground.

b. As is indicated by the footnotes to this chart, all measurements were made with a 20,000 ohm per volt DC meter, Navy Model OE Series, and a 1000 ohm per volt AC meter such as Multimeter AN/PSM-4, TS-352/U Series or equivalent.

6. WINDING DATA.

Complete winding data for all wire-wound units (except resistors) in the AN/URM-25E is given in Table 6–7 WINDING DATA.

7. EXTERIOR AND INTERIOR VIEWS OF UNITS.

To assist the technician doing maintenance work in locating the positions of the various coils, capacitors, resistors, switches, etc., comprising the signal generator, there will be found in this section additional photographic illustrations. They show every part of the RF Signal Generator Set AN/URM-25E with the corresponding symbol designation indicated. These will facilitate the easy and quick identification of all parts.

8. REMOVING THE SIGNAL GENERATOR AND POWER SUPPLY FROM THE CABINET.

a. Removing the RF Signal Generator SG-111/URM-25E. – Since this is a precision instrument, great care should be taken in removing the RF Signal Generator from the cabinet to make repairs. Before attempting to disassemble the unit, be sure that the equipment is disconnected from the power source. Adhere carefully to the following procedure:

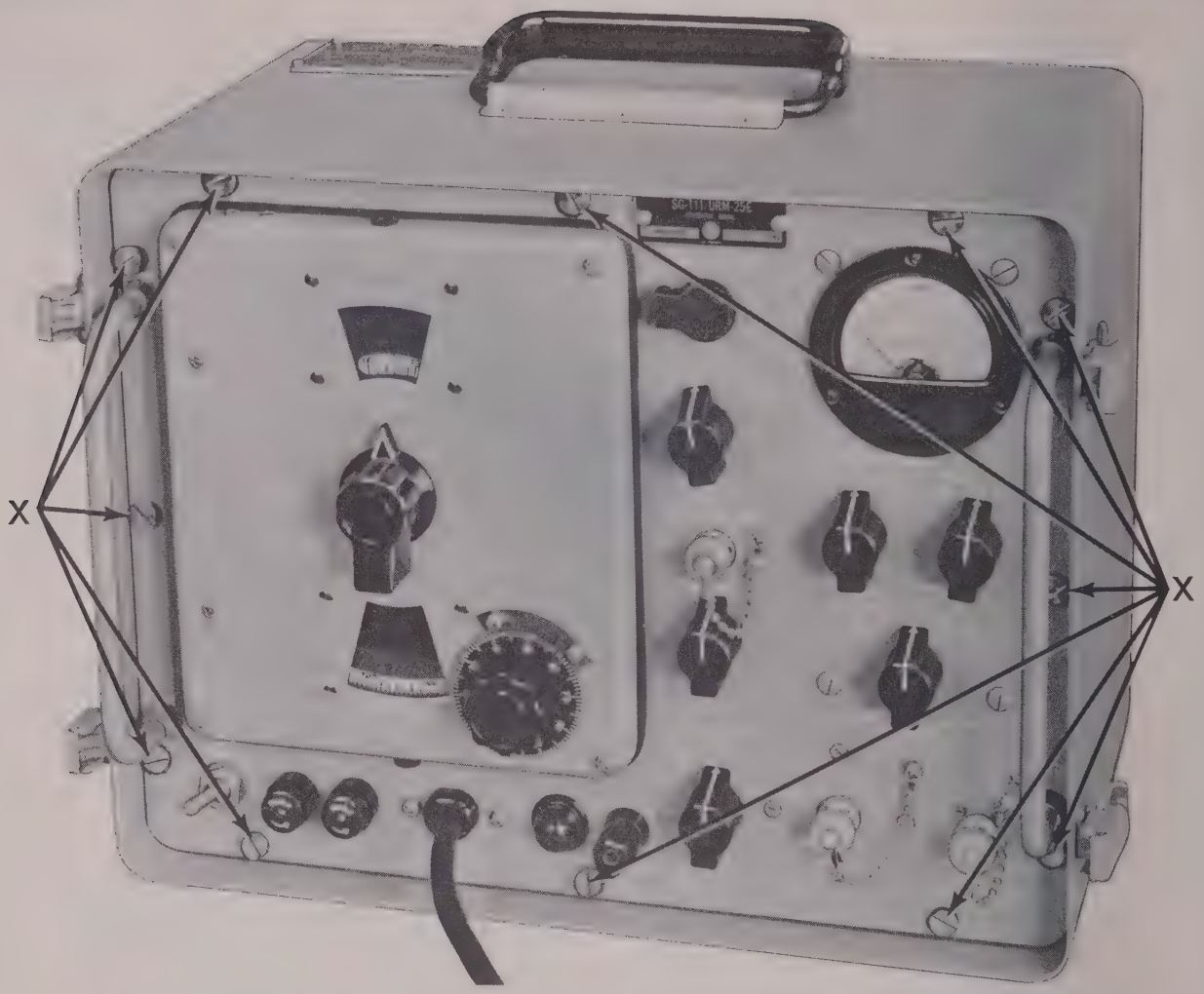


Figure 6—2. Front Panel View for Removal of RF Signal Generator SG-111/URM-25E from Cabinet

(1) Loosen the twelve captive screws (x) located around the outer edge of the panel (figure 6—2).

(2) Gently pull the generator chassis about eight inches from the cabinet, using the lifting handles provided on the front panel. The generator unit cannot be completely removed since the interconnecting power cable (W108) and output power cable (W103) are still connected to the power supply sub-chassis.

(3) Remove the output power supply connector (P102) and the AC input connector (P101) from the power supply sub-chassis. The generator sub-assembly can now be removed. The power supply sub-chassis will remain in the cabinet.

b. Removing the Power Supply PP-1205/URM-25E. —

(1) To remove the power supply take out the eight binding head screws (Y) located on the bottom and on the rear of the cabinet. (See figure 6—3.)

(2) With the signal generator and power supply sub-assemblies removed from the cabinet, the equipment

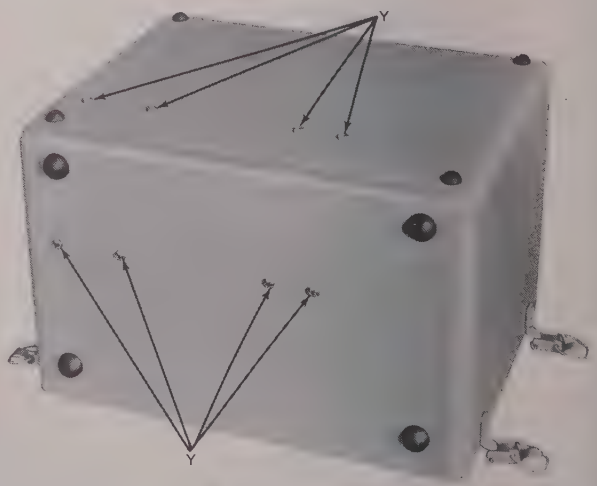


Figure 6—3. Rear Bottom View for Removal of Power Supply PP-1205/URM-25E

can again be connected for use and testing by applying the following procedure (figure 6–4):

(*a*) Insert interconnecting power cable plug (P101) into the power supply input receptacle (J201) and P102 into J202.

(*b*) Insert the plug P110 on the end of the power cable (W109) into the AC source.

WARNING

Voltages up to 450v will be exposed when the signal generator is being tested outside the cabinet. Exercise great care in handling the instrument under these conditions.

9. REMOVAL AND REPLACEMENT OF PARTS.

a. Whenever repairs are made involving the removal or replacement of any component part, the part removed should be marked or tagged for identification and its exact position in the equipment carefully noted and recorded so that when the same or new part is replaced the equipment will be precisely as before. This precaution is particularly necessary when RF components, such as coils and capacitors, are replaced. The location of these parts with respect to associated components will play an important role in the performance of the equipment.

b. Whenever any parts are replaced by new ones always use the identical type listed and described in Section 7, Table 7–2 TABLE OF REPLACEABLE PARTS. If such parts cannot be obtained, substitute only similar parts with equivalent electrical and mechanical characteristics. If precision parts are not available and it is absolutely necessary to use the equipment, a temporary substitute of approximate value may be inserted. This is not recommended as a normal procedure and the exact replacement should be ordered. The unsatisfactory substitute should be removed as soon as the exact replacement is received.

10. REMOVAL OF RF OSCILLATOR BRACKET ASSEMBLY.

(See figure 6–8.)

a. Remove the three screws and lockwashers on the right-hand side of the signal generator (when viewed from the rear) that hold the bracket to the casting.

b. Remove the small nut holding the grounding strap on the edge of the bracket.

c. Make a note of all tube socket connections and then unsolder them.

d. The oscillator bracket assembly may now be removed from the unit. Care should be exercised not to damage any of the components when removing this assembly.

e. After replacing defective parts, resolder all the tube socket connections, mount this bracket back in place with the three screws and lockwashers and replace the grounding strap.

11. REMOVAL OF CRYSTAL CALIBRATOR BRACKET ASSEMBLY.

(See figure 6–9.)

a. Remove the two screws and lockwashers from the bottom of the signal generator which hold the crystal calibrator bracket assembly in place.

b. Remove the bracket assembly slowly to prevent damaging any parts or lead connections.

c. Make a note of all connections before unsoldering. Replace defective parts, resolder all connections and mount the bracket assembly in place with the two screws and lockwashers.

12. REMOVAL OF AUDIO COMPARTMENT ASSEMBLY.

(See figures 6–13 and 6–16.)

a. Remove the three knobs titled as follows:

(1) SET CARRIER TO 10 (E114).

(E115).

(2) % MOD – AUDIO OUT – XTAL CAL OUT

(3) MOD – XTAL & METER SELECTOR (E117).

b. Disconnect the lead from the EXT MOD IN – AUDIO OUT – XTAL CAL OUT jack (J105).

c. Disconnect the two leads from the rear of the meter M101.

d. Remove four screws and lockwashers on the front panel which will permit removal of the audio compartment assembly.

e. Note all connections before unsoldering. Replace defective parts and resolder all connections properly.

f. If the meter is to be replaced, remove the three screws on the front panel that hold the meter in place, then remove the meter. Mount a new meter in place with the three screws.

g. Re-mount the audio compartment assembly with the four screws. Connect the two leads to the rear of the meter.

h. Connect the lead to the EXT MOD IN AUDIO OUT XTAL CAL OUT jack (J105).

i. Replace all knobs in their proper position.

13. REMOVAL OF STEP ATTENUATOR.

(See figures 6–13 and 6–20.)

a. Note the position of the RF MULTIPLIER knob (E118) and remove it and the cap from the RF OUTPUT X-MULT jack (J102). Remove the four screws positioned around the jack on the front panel.

b. Disconnect the lead which is connected to the buffer-amplifier compartment and remove the step attenuator.

Note

Mark the position of the gear teeth before removing the step attenuator.

c. Replace any defective resistors or gears if damaged.

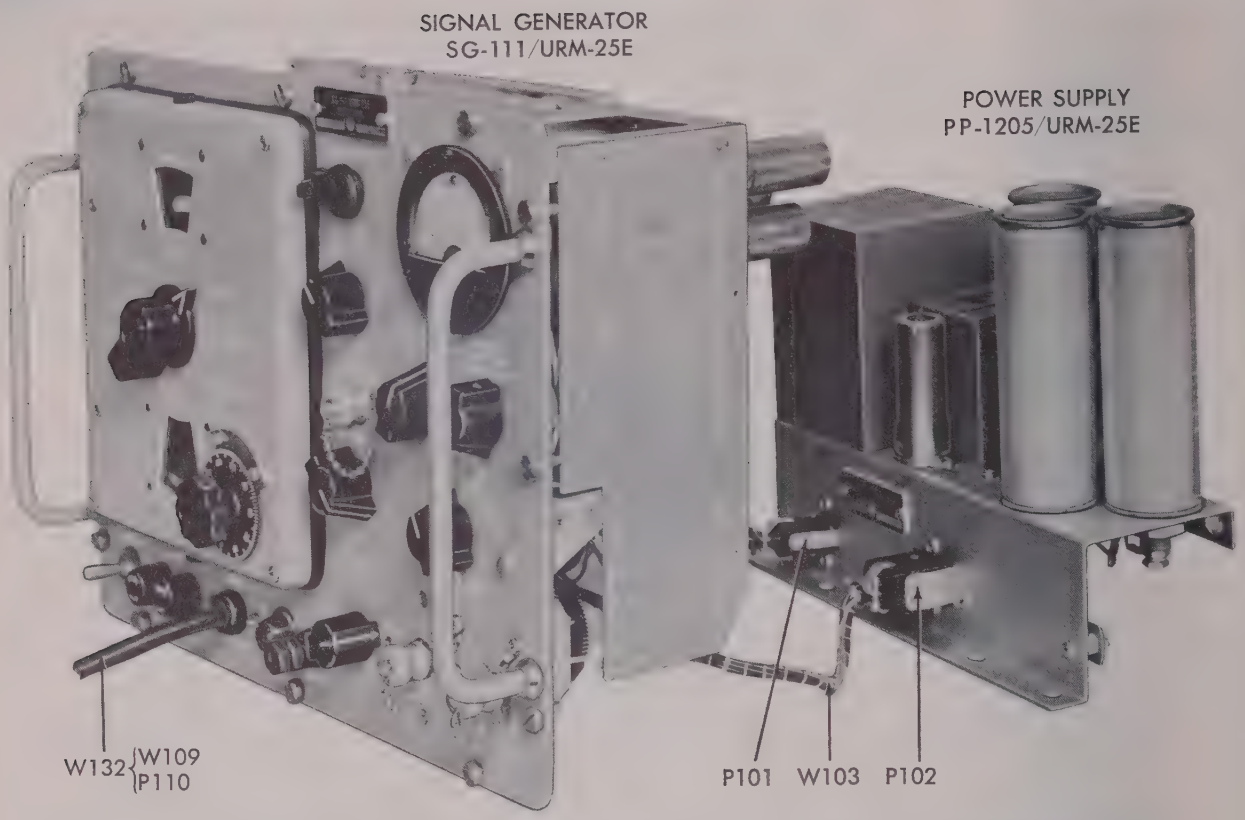


Figure 6—4. RF Signal Generator SG-111/URM-25E and Power Supply PP-1205/URM-25E Connected Outside Cabinet for Testing

Note

When replacing any defective resistors, extreme care should be taken not to overheat them while soldering in place since this may destroy their 1% accuracy.

d. Mount the step attenuator in place, and position the gear teeth properly. Replace the four screws, the knob, and cap.

14. REPLACING RF OSCILLATOR CIRCUIT COMPONENTS.

(See figures 6—8, 6—10, 6—11, 6—13, 6—18 and 6—19.)

a. The RF oscillator frequency determining components L101 through L108 and C101 through C116 should not normally be replaced in the field unless the necessary calibrating instruments are available. These instruments include RF heterodyne frequency meters that cover from 10 kc to 50 mc with an accuracy of at least 0.05% (e.g. Navy Model LR and Signal Generator TS-535/U).

b. Changing the oscillator tube should not normally cause error in calibration. However, when replacing the oscillator tube, the signal generator should be recalibrated as soon as the necessary test equipment is available (e.g. Navy Model AN/USM-29 and Signal Generator TS-535/U).

15. REPLACING BUFFER AMPLIFIER CIRCUIT COMPONENTS.

(See figures 6—5, 6—6, and 6—7.)

The buffer amplifier compartment is located between the carrier oscillator and audio compartments. It contains the buffer stage (V102), output amplifier stage (V103), and VTVM (V104) circuits, in addition to the MICROVOLTS control (R119), carrier range switch (S101), and the meter zero control (R127) which are mounted on a removable chassis. If necessary to remove this unit when making repairs, proceed in the following manner:

a. Remove the buffer-amplifier and oscillator compartment cover plate.

b. Remove carrier range switch knob (E113) and MICROVOLTS control knob (E116) located on the front panel of the signal generator.

c. Make a sketch of all connections which must be unsoldered in order to remove the unit and then unsolder them.

d. Remove the three mounting screws which attach the buffer amplifier unit inside the compartment and carefully lift the unit assembly from the casting.

e. After the defective components are replaced, mount the unit back in place and resolder all disconnected leads.

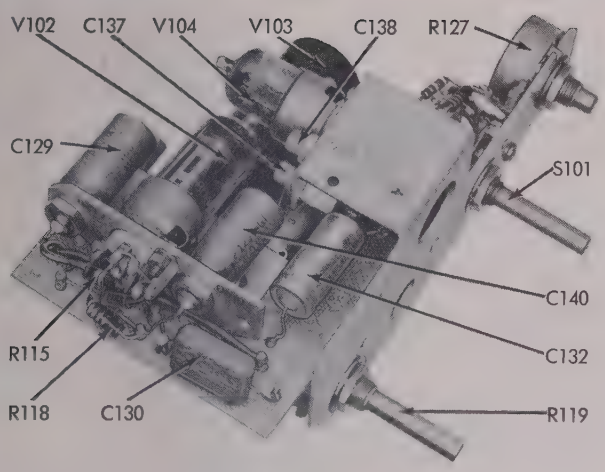


Figure 6–5. Side View of Buffer Amplifier Unit

16. READJUSTMENT OF FREQUENCY CALIBRATION.
(See figure 6–12.)

a. When to Calibrate. – The signal generator should be recalibrated whenever oscillator coils or capacitors are replaced and whenever it is suspected that the frequency error is in excess of ±1%. This recalibration is accomplished by adjusting the applicable coils and trimmers as discussed in paragraph 17 of this section.

b. Limitations of Crystal Calibrator (V105) for Frequency Recalibration.—The use of the integral crystal calibrator for interpolative calibration was discussed in Section 4, par. 4.b. When used in this manner, the accuracy of the signal generator is increased from the rated ±0.5% to ±0.05% at frequencies above 1 mc. Since the crystal calibrator operates on the harmonic generation principle, it is limited as a recalibrating device when some circuit defect or replacement introduces a frequency error greater than 1%. For example, if for some reason, the frequency error at 50 mc is —2%, the frequency scale will read 50 mc when actual frequency is 51 mc. Since zero beats occur at both 50 mc and 51 mc (1 mc apart), it will be difficult to determine which point corresponds to 50 mc. Similarly, at lower frequencies (down to 1 mc), the combination of signal generator and crystal calibrator harmonics may introduce beats at intervals closer than 1 mc. Since the accuracy of the signal generator is better than ±0.5%, there will be no problem in determining the applicable beat for interpolative calibration. When recalibrating the instrument because of errors greater that 1%, however, the instruments recommended in the following paragraph should be used to avoid any possible confusion.

c. Recommended Test Equipment for Recalibrating. –

(1) Navy Model AN/USM-29 Frequency Meter.

(2) Set of earphones for monitoring zero beat.

Note

Figure 6–11 shows the locations of the trimmers and inductances that may require readjustment. Make sure that only the parts relevant to the frequency band being calibrated are adjusted. Follow the calibration procedure and do not turn screws indiscriminately.

17. FREQUENCY CALIBRATION PROCEDURE.
(See figure 6–12 and Table 6–1.)

a. General. –

(1) When the frequency error of the signal generator is in excess of 1%, it will be necessary to recalibrate the instrument. In making the necessary adjustments, the RF Signal Generator SG-111/URM-25E must first be removed from the cabinet. Follow the procedure outlined in Section 6, par. 8 for removing the signal generator unit.

(2) Over the frequency range covered by Bands A through H (10 kc through 50 mc), each oscillator coil has connected across it a trimmer capacitor for adjusting the total capacitance associated with it. Each corresponding coil also has a movable powdered iron slug by means of which the inductance of that coil can be adjusted to the required value.

(3) In using the heterodyne frequency meters referred to in paragraph 16 of this section, connect the output test cable (W106) to the heterodyne frequency meter. Plug a pair of earphones into the audio output of the frequency meter. Make the necessary capacitance and inductance adjustments while listening for a zero beat on the earphones.

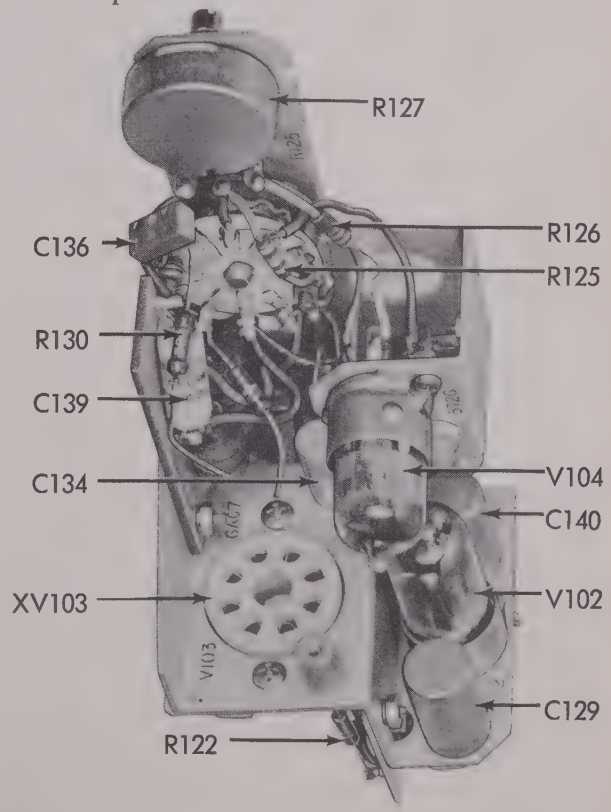


Figure 6–6. Top Rear View of Buffer Amplifier

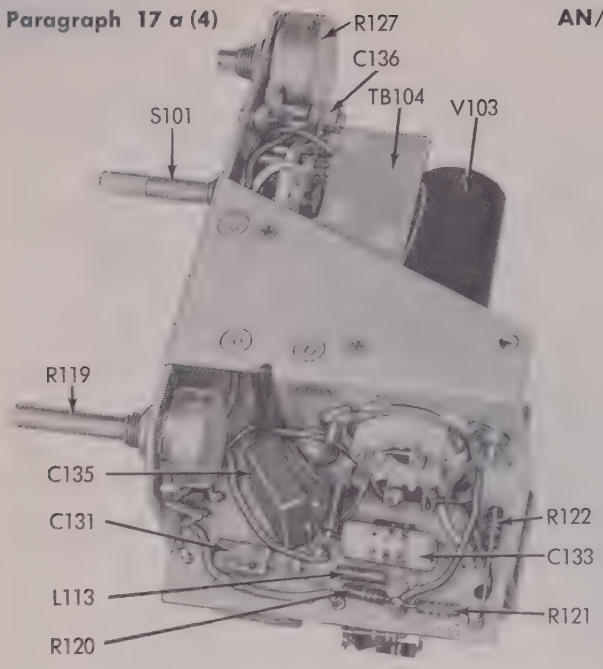


Figure 6–7. Bottom View of Buffer Amplifier

(4) For calibrating frequency ranges below 100 kc, use the Signal Generator TS-535/U. Feed the output from the RF Signal Generator Set AN/URM-25E and Signal Generator TS-535/U to the horizontal and vertical inputs, respectively, of an oscilloscope, such as Oscilloscope OS-8/U (See figure 6 – 12). Adjust the frequency of the RF Signal Generator Set AN/URM-25E to the same frequency as the Signal Generator TS-535/U as indicated by a zero-shaped Lissajou pattern. Be sure to calibrate the Signal Generator TS-535/U according to its instruction book before using it as a standard in this procedure.

(5) In the event that Signal Generator TS-535/U is not available, the AN/USM-29 or the AN/URM-82 frequency indicating equipment may be used to calibrate this instrument. Figure 6–12 shows the methods of calibration using the various referenced test equipments. Note that when using the AN/USM-29 for calibration purposes, either the built-in scope or an external oscilloscope may be utilized. An external scope must be used, however, with the AN/URM-82. Because of the frequency limits (10 kc to 30 mc) of the AN/USM-29, 2:1 Lissajou signal frequency patterns will have to be used for frequency calibration above approximately 30 mc.

b. Frequency Calibration Chart. – Table 6 – 1 is a chart for calibrating frequency and the necessary adjustment to be made on all bands. When calibrating frequency, follow the points and procedures therein contained.

c. Calibration Procedure. – See figure 6–12 and Table 6–1.)

(1) To make the necessary r-f trimmer and coil adjustments, it will be necessary to remove the spring type button plug in the disc cover on the top of the casting. It is also necessary to remove the screw plug from the lefthand side (facing front of signal generator) of the casting to provide access to the oscillator coil slug adjustment. Identification of the appropriate coil and capacitor is not necessary, since the correct components are automatically aligned with the access holes for each band.

(2) The recalibration process consists of (a) adjusting the inductance for frequency calibration at the low-frequency end of the range, (b) adjusting the corresponding trimmer capacitor for a calibration point at the high end of the range, (c) rechecking the low end plus coil adjustment if necessary, (d) rechecking the high end if adjustment in step c is required, and (e) checking the center portion of range selected.

(3) After the adjustment has been made, replace the button and plug and recheck calibrations. If the calibrations have been changed when this plate is replaced, readjust the applicable trimmer or core to compensate for this effect.

CAUTION

After the necessary adjustments have been made, on the upper and lower ends of the band being calibrated, the corresponding calibrations should be correct throughout the frequency range. If not, the main tuning capacitor (C123) may be defective. One common way that this variable capacitor becomes defective is through "plate bending". Never bend the plates of the main tuning capacitor (C123) in attempting to make an adjustment.

18. CALIBRATING THE VOLTMETER.

(See figures 6–16 and 6–17.)

a. General. – In the course of operating the equipment it may be discovered that the meter M101 does not indicate what it should. This can readily be determined by applying the procedures outlined in Section 5, Table 5–1 – ROUTINE CHECK CHART, and by making the necessary adjustments outlined in this paragraph.

Note

All voltmeter adjustments (R169 and R172) are of the screwdriver type and are located in the audio compartment. Figure 6–16 identifies these controls.

b. Zero Adjustment. – If the meter M101 does not read zero in the carrier position of the MOD XTAL & METER SELECTOR switch (S102), when the carrier control (R173) and audio output control (R165) are set fully counterclockwise, make this adjustment:

(1) Set carrier control (R173) and audio output control (R165) to the fully counterclockwise positions (zero carrier and zero modulation).

(2) Set the MOD XTAL & METER SELECTOR switch (S102) to the carrier position. The output from V103 is now applied to the cathode of the VTVM tube

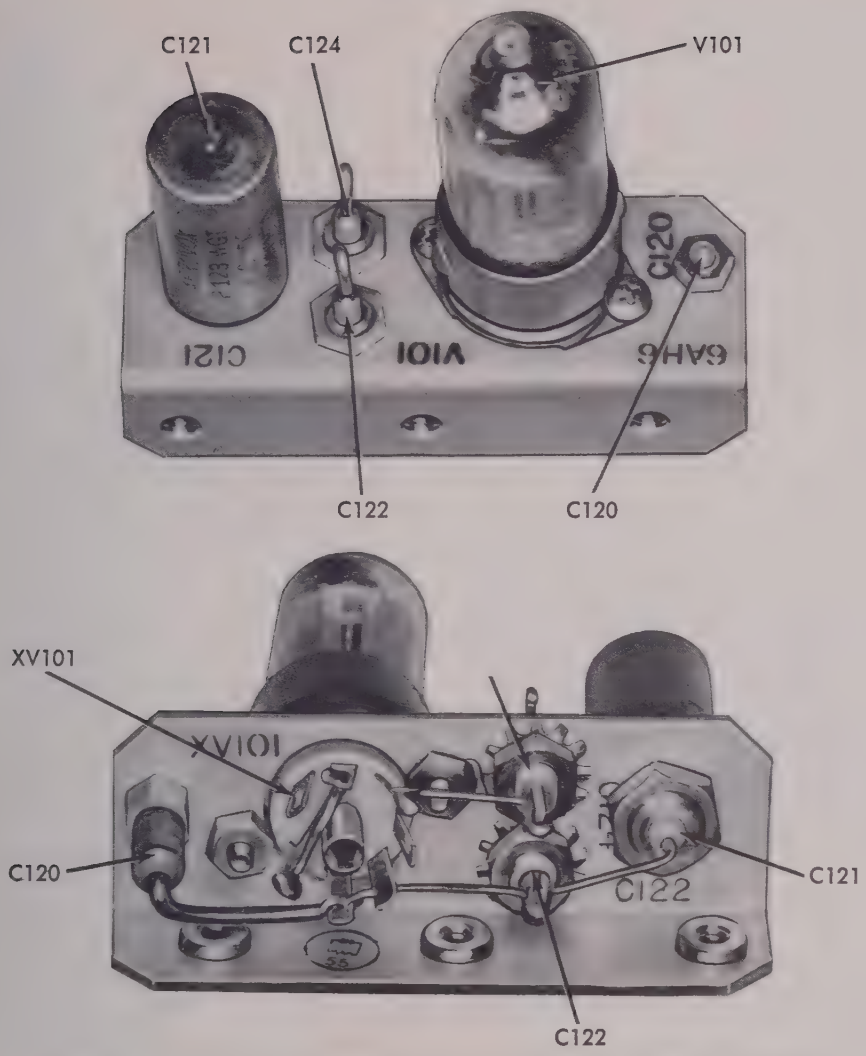


Figure 6–8. Top and Bottom Views of Carrier Oscillator Bracket

(V104A). Since the carrier control (R173) was set for zero signal output (fully counterclockwise), there should be no voltage applied to the cathode of the tube (V104A), and the meter M101 should still indicate zero. However, if a reading other than zero is reflected by the meter, adjust the CARRIER METER ZERO control (R127) until a zero meter reading is obtained. This adjustment compensates for the contact potential that may be present across the VTVM (V104).

(3) Set the MOD XTAL & METER SELECTOR switch (S102) to the % MOD position. The output from (V107) is now applied to the crystal unit (CR101, CR102). Since the % MODULATION control (R165) was set to the fully counterclockwise position, there should be no voltage applied to the crystal unit.

c. RF Output Voltage Calibration (upper meter scale). –

(1) Turn the MICROVOLTS control (R119) to the fully clockwise position.

(2) Set the carrier control (R173) to the fully counterclockwise position.

(3) Set MOD XTAL & METER SELECTOR switch (S102) to the carrier position.

(4) Set frequency at 100 kc.

(5) Place an electronic voltmeter, such as Multimeter ME-25/U or equal, between one center contact of the RF OUTPUT X-200,000 jack (J101) and ground.

(6) Rotate the carrier control (R173) in a clockwise direction until 2.0 volts are indicated on the test meter. The signal generator meter (M101) should read "10" on the upper scale. This represents 2.0 volts output when the RF OUTPUT X-200K jack (J101) is open circuited.

(7) Adjust the RF sensitivity control (R172) until the signal generator meter (M101) reads "10" on the upper scale when the test meter reads 2.0 volts.

(8) To maintain a calibrated output voltage from the RF OUTPUT X-MULT jack (J102) when operating

the signal generator, first rotate the carrier control potentiometer (R173) to the fully counterclockwise position. Turn the carrier control in a clockwise direction until the meter M101 reads "10". The output from this jack can now be varied by rotating the MICROVOLTS potentiometer (R119) in a counterclockwise direction by selecting the desired attenuation with the RF MULTIPLIER knob (E118). Once the carrier level has been set at "10", the carrier control (R173) should never be used to vary the output from the RF OUTPUT X MULT jack (J102). Before changing frequency, the carrier control (R173) should first be returned to the fully counterclockwise position and then advanced to the carrier level of "10", after the desired frequency has been selected.

d. Percentage Modulation Calibration (lower meter scale. — (See figure 6—14.)

(1) Set carrier frequency at 100 kc.

(2) Set MOD XTAL & METER SELECTOR switch (S102) to the % MOD. position (400 cycles per second).

(3) Set carrier range switch (S101) to the 10 kc-300 kc position.

(4) Feed the output from the RF OUTPUT X-MULT jack (J102) to the vertical input of a test oscilloscope.

(5) Place a graduated celluloid screen over the face of the oscilloscope.

(6) With the RF MULTIPLIER knob (E118) and MICROVOLTS control (R119), adjust the modulated signal amplitude to cover approximately 75 per cent of the oscilloscope face.

(7) Adjust the audio output control (R165) on the front panel until 50 per cent modulation is indicated on the oscilloscope, figure 6—14.

(8) Adjust the sensitivity control (R169) until the meter M101 also indicates 50 percent on the modulation scale (lower scale).

(9) Adjust the audio output control (R165) on the front panel until 30 per cent modulation is indicated on the oscilloscope.

(10) Check the reading of the meter.

(11) If necessary readjust R169 until 30 per cent and 50 per cent readings are both as accurate as possible, favoring the 30 per cent adjustment since this value is used most often.

19. CALIBRATING THE STEP ATTENUATOR (AT101).

a. The voltage attenuation of the step attenuator (AT101) should be checked whenever a resistor in this unit is replaced. Use the (10:1) Fixed Attenuator CN-283/U and a radio receiver which receives 100 kc for making this check as follows:

(1) Set the RF Signal Generator Set AN/URM-25E for 100 kc carrier frequency with 30% modulation at 400 cycles.

(2) Connect the (10:1) Fixed Attenuator CN-283/U to J102 and terminate it with the Impedance Matching Network CU-411/URM-25E.

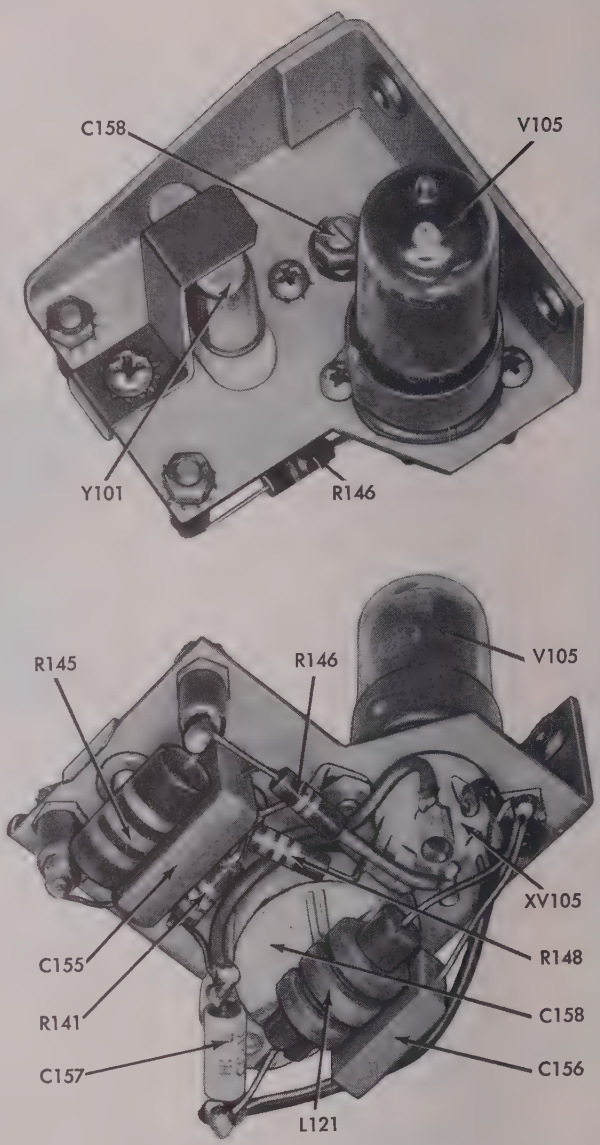


Figure 6—9. Top and Bottom View of Crystal Calibrator Bracket

(3) Connect the impedance matching network output to the receiver.

(4) Adjust the output of the signal generator for a reading of "10" on M101.

(5) Set the RF MULTIPLIER knob (E118) one range above the range in which the resistor was replaced.

(6) Connect a voltmeter such as Multimeter ME-25/U series or equivalent across the output of the receiver.

(7) Tune the receiver to the frequency (100 kc) of the signal generator and record a reference receiver output as indicated by the multimeter.

(8) Reset the RF MULTIPLIER knob (E118) to the attenuation range in question (next lower range).

(9) Remove the (10:1) Fixed Attenuator CN-283/U and connect the signal generator output at J102 to the Impedance Matching Network CU-410/URM-25E.

(10) Advance the MICROVOLTS control (E116) in a clockwise direction for a meter reading of "10".

(11) The receiver output should be within ±2% as was indicated in step 7 above. If it is not, the resistor on this range should be replaced.

Note

Use a very hot soldering iron when replacing resistors in the step attenuator (AT101). Apply the iron to the solder surface for a very short period of time. Too long a period of heating may cause the precision resistors to change in value.

b. Whenever it is suspected that the step attenuator ratios are not correct, the procedures outlined in paragraph 19a above may be used as a check. A more complete analysis of step attenuator troubles is given in Table 6–4 – CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE.

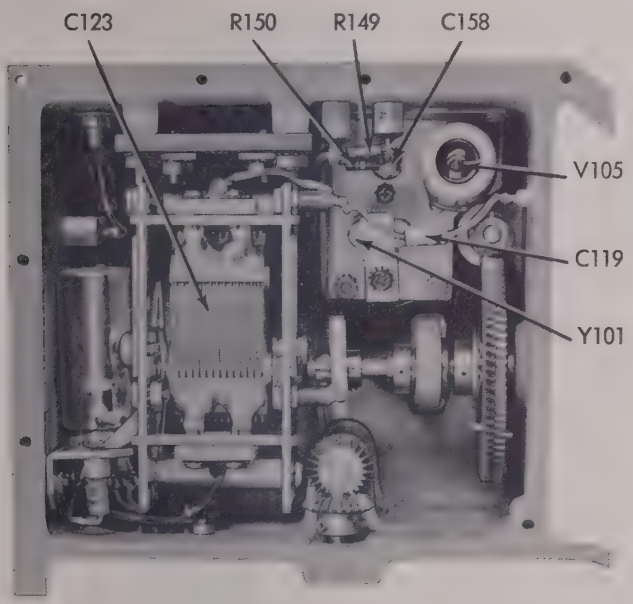


Figure 6–10. Rear View of Oscillator Compartment

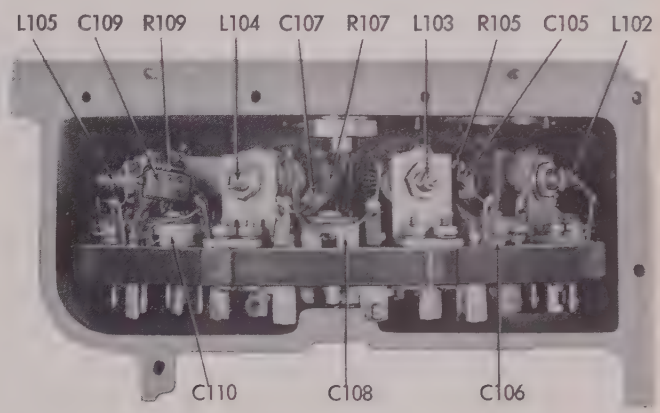


Figure 6–11. Rear View of Turret Selector Switch

TABLE 6–1. FREQUENCY CALIBRATION DATA

FREQUENCY RANGE	LOW END – ADJUST INDUCT.		HIGH END – ADJUST CAP.	
	FREQ.	COIL	FREQ.	CAP.
A	10 Kc	L101	30 Kc	C102
B	30 Kc	L102	95 Kc	C104
C	95 Kc	L103	300 Kc	C106
D	300 Kc	L104	950 Kc	C108
E	0.95 Mc	L105	3.0 Mc	C110
F	3.0 Mc	L106	9.5 Mc	C112
G	9.5 Mc	L107	30 Mc	C114
H	30 Mc	L108	50 Mc	C116

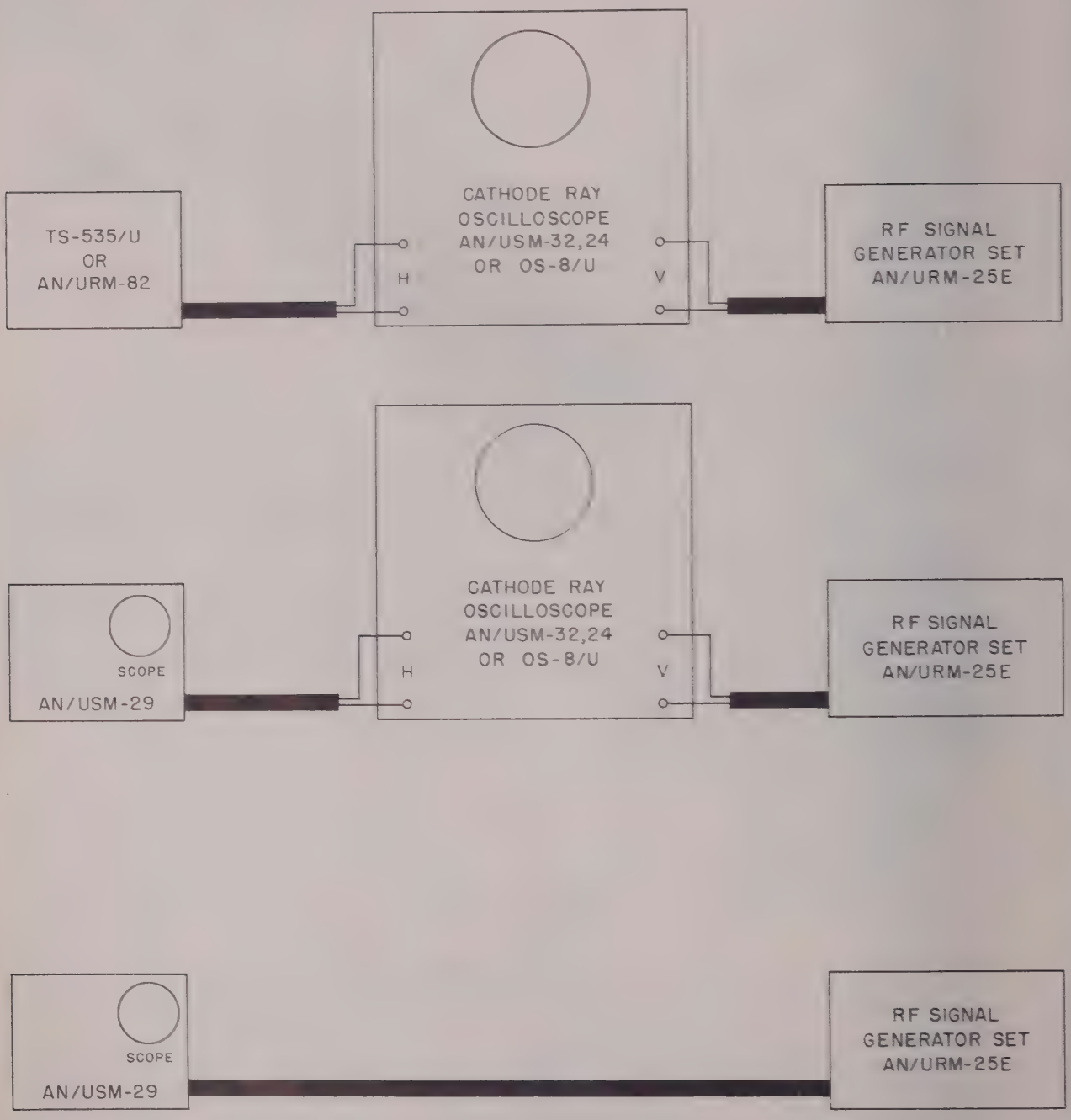
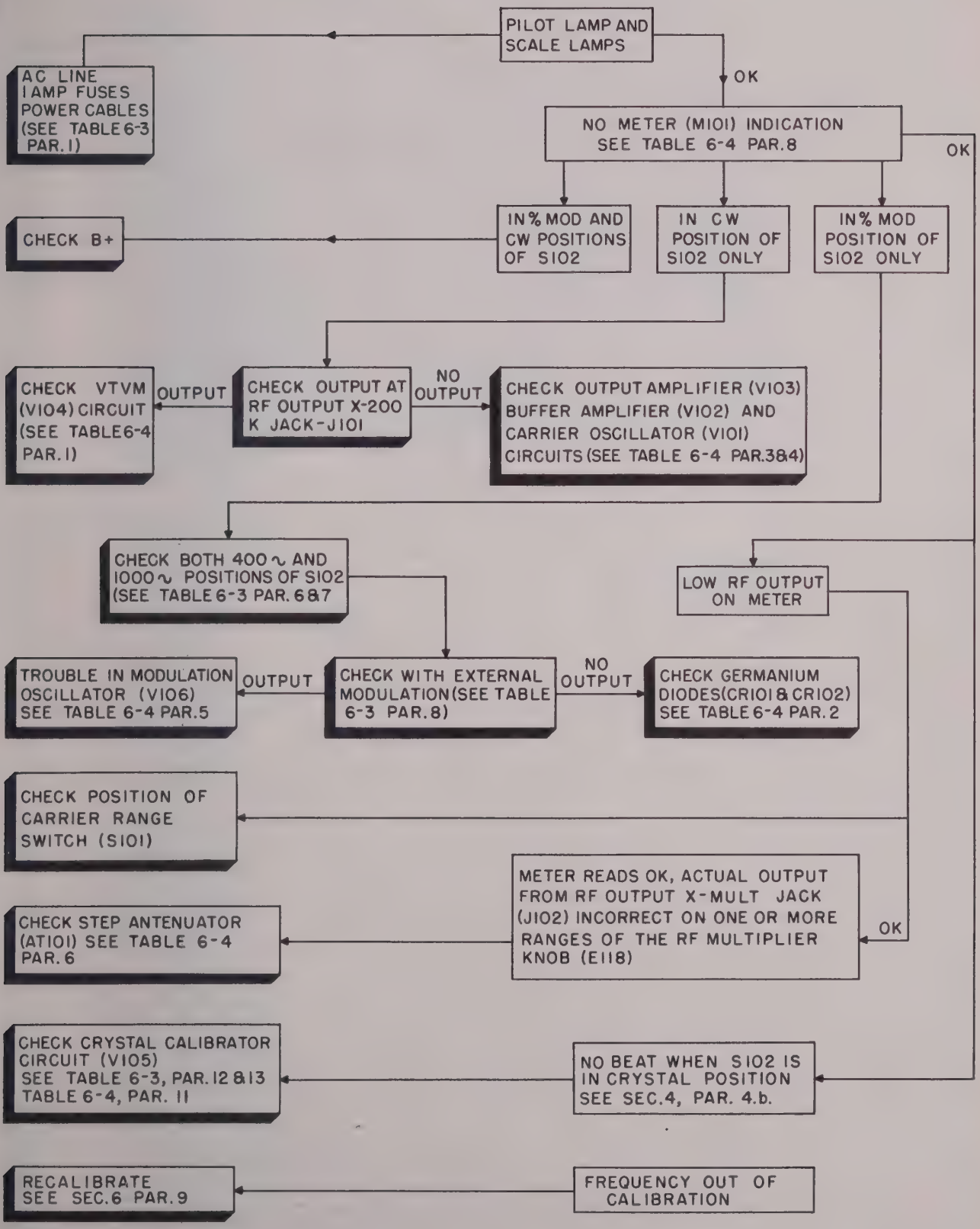


Figure 6—12. Method for Calibrating the RF Signal Generator Set AN/URM-25E at Frequencies below 100 Kilocycles

TABLE 6–2. TROUBLE SYMPTOM CHART


PILOT LAMP AND SCALE LAMPS
AC LINE 1 AMP FUSES POWER CABLES (SEE TABLE 6-3 PAR. 1)
OK
NO METER (M101) INDICATION SEE TABLE 6-4 PAR. 8
OK
IN % MOD AND CW POSITIONS OF S102
IN CW POSITION OF S102 ONLY
IN % MOD POSITION OF S102 ONLY
CHECK B+
CHECK VTVM (V104) CIRCUIT (SEE TABLE 6-4 PAR. 1)
OUTPUT
CHECK OUTPUT AT RF OUTPUT X-200 K JACK-J101
NO OUTPUT
CHECK OUTPUT AMPLIFIER (V103) BUFFER AMPLIFIER (V102) AND CARRIER OSCILLATOR (V101) CIRCUITS (SEE TABLE 6-4 PAR. 3&4)
CHECK BOTH 400 ∿ AND 1000 ∿ POSITIONS OF S102 (SEE TABLE 6-3 PAR. 6&7
LOW RF OUTPUT ON METER
TROUBLE IN MODULATION OSCILLATOR (V106) SEE TABLE 6-4 PAR. 5
OUTPUT
CHECK WITH EXTERNAL MODULATION (SEE TABLE 6-3 PAR. 8)
NO OUTPUT
CHECK GERMANIUM DIODES (CR101 & CR102) SEE TABLE 6-4 PAR. 2
CHECK POSITION OF CARRIER RANGE SWITCH (S101)
METER READS OK, ACTUAL OUTPUT FROM RF OUTPUT X-MULT JACK (J102) INCORRECT ON ONE OR MORE RANGES OF THE RF MULTIPLIER KNOB (E118)
OK
CHECK STEP ANTENUATOR (AT101) SEE TABLE 6-4 PAR. 6
CHECK CRYSTAL CALIBRATOR CIRCUIT (V105) SEE TABLE 6-3, PAR. 12 &13 TABLE 6-4, PAR. 11
NO BEAT WHEN S102 IS IN CRYSTAL POSITION SEE SEC. 4, PAR. 4.b.
RECALIBRATE SEE SEC. 6 PAR. 9
FREQUENCY OUT OF CALIBRATION

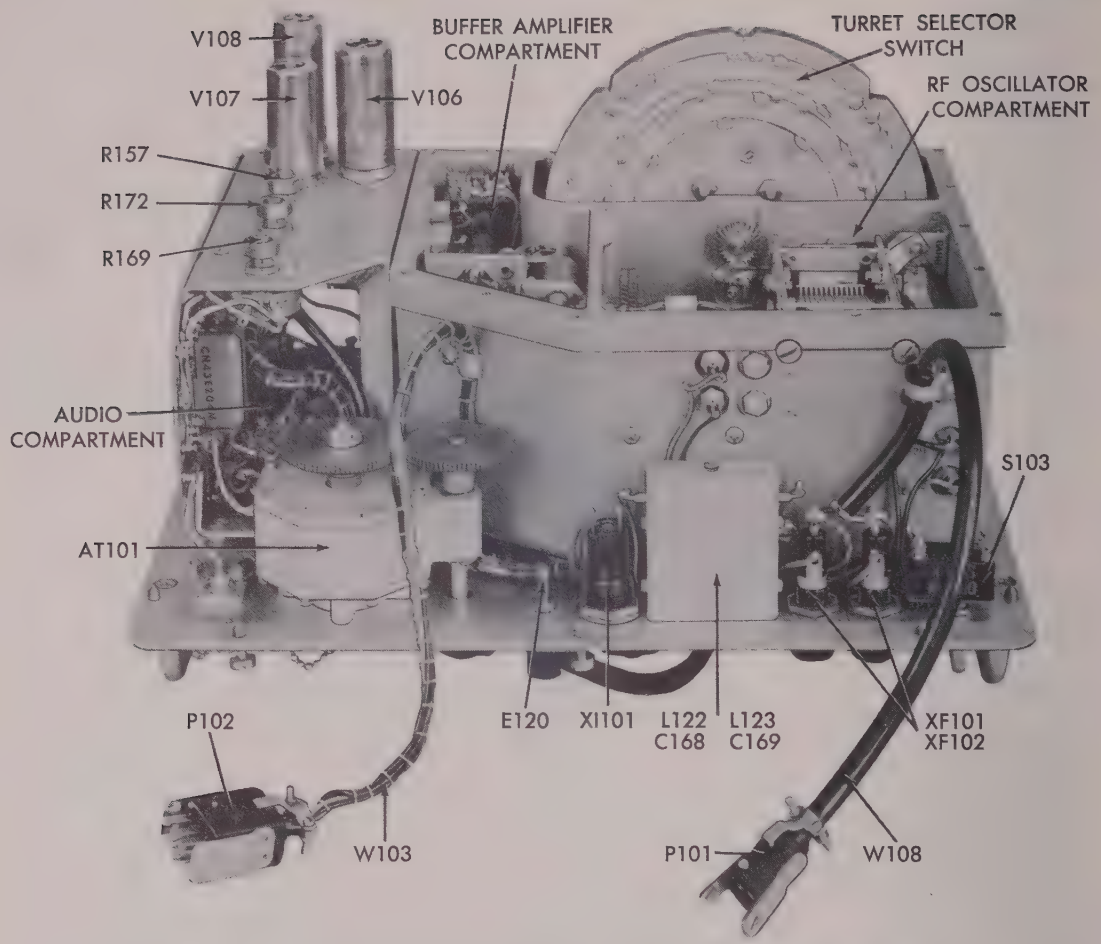


Figure 6—13. Bottom View of Signal Generator SG-111/URM-25E

TABLE 6—3. CHART OF GENERAL TEST PROCEDURE FOR LOCALIZING TROUBLE

NOTE: The CARRIER (R173) and % MOD, AUDIO OUT, XTAL CAL OUT (R165) controls should always be turned fully counterclockwise before turning power on.

LOCALIZATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
POWER SUPPLY.	1. Make sure the indicating lamp (I101) or scale lamps (E121 and E122) have been made to light, as evidence that the 115-volt supply mains, fuses, and at least a part of the power supply system is in working order. If none of these lamps light, see Table 6—4, par. 7 on POWER SUPPLY.
VTVM	2. Set the signal generator controls in the following position: *a.* POWER Switch (S103) OFF. *b.* MOD XTAL & METER SELECTOR switch (S102) at CW. *c.* Carrier range switch (S101) at applicable range. *d.* Carrier control (R173) in extreme counterclockwise position. *e.* % MOD AUDIO OUT XTAL CAL OUT control (R165) in extreme counterclockwise position. *f.* Frequency band switch (E119) set for any one of eight ranges.
	3. Turn the POWER switch (S103) ON. The meter needle should be at the first line on the left. If it can not be zero set see Table 6—4, par. 1 on VTVM circuit trouble.

TABLE 6–3. CHART OF GENERAL TEST PROCEDURE FOR LOCALIZING TROUBLE *(Continued)*

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
CARRIER OSCILLATOR, VTVM, BUFFER and OUTPUT AMPLIFIER	4. Advance the carrier control (R173) slowly in a clockwise direction. The meter needle should move up scale correspondingly. If it does, the VTVM, carrier oscillator (at least one range), power supply, buffer and output amplifier are functioning. 5. Set the frequency band switch (E119) successively for each range to see if operation (as in par. 4 above) is obtained for all ranges. If it is, the carrier oscillator, buffer and output amplifiers are functioning. Operation on some bands and not on others probably indicates a defect in the carrier oscillator (see Table 6–4, par. 4 on CARRIER OSCILLATOR); since the buffer and output amplifiers are untuned and should respond at all frequencies if they respond at one. 6. If, in par. 4 and 5 above, the meter does not move up scale, turn the MOD XTAL & METER SELECTOR switch (S102) to the 400-cycle position. Slowly advance the % MOD AUDIO OUT XTAL CAL OUT control (R165) in a clockwise direction. If the meter now moves up scale, it indicates that there is trouble in the carrier oscillator, VTVM, or buffer and output amplifier circuits. (See Table 6–4 Sections on CARRIER OSCILLATOR, VTVM, BUFFER and OUTPUT AMPLIFIER.) This also indicates that the modulation oscillator and modulation crystal voltmeter circuits are functioning.
MODULATION OSCILLATOR	7. If the meter responds to the tests in par. 4 and 5, but not in par. 6 above, the trouble is in the modulation oscillator or modulation crystal voltmeter. 8. With the MOD XTAL & METER SELECTOR switch (S102) at EXT position, carrier range switch (S101) at applicable range, apply an external audio signal (1000 cycles) to the EXT MOD IN AUDIO OUT XTAL CAL OUT jack (J105). Slowly advance the % MOD AUDIO OUT XTAL CAL OUT control (R165) in a clockwise direction. If the meter now moves up scale, it indicates that the trouble is in the modulation oscillator.
MODULATION CRYSTAL VOLTMETER	9. If the meter still does not respond to the % MOD AUDIO OUT XTAL CAL OUT control (R165), feed the output signal from the RF OUTPUT X-200K jack (J101) to a test oscilloscope. Set the carrier frequency at 100 kc. Place the MOD XTAL & METER SELECTOR switch (S102) in the CW position. Advance the carrier control (R173) in a clockwise direction until a reading of "10" is obtained on the upper meter scale. With the external modulation applied as in par. 8 above, the modulated pattern should appear on the oscilloscope (figure 6–12). If it does, the trouble was in the modulation crystal voltmeter.
STEP ATTENUATOR (AT101) OR OUTPUT CABLES	10. If the meter responds to the above tests in a satisfactory manner, but there is still no output voltage at the end of output cable (W106), the trouble is in the attenuator (AT101) or output test cable (see Table 6–4, par. 6 and par. 10).
POWER SUPPLY	11. If no meter response or output voltage is obtained from the foregoing tests, the trouble is probably in the power supply (see Table 6–4, par. 7).
CRYSTAL CALIBRATOR	12. Turn MOD XTAL & METER SELECTOR switch (S102) to XTAL position. Connect a set of earphones to EXT MOD IN AUDIO OUT XTAL CAL OUT jack (J105) using 6" cable (W105) and Connector Adapter UG-201/U. Tune signal generator to some even multiple of 1 mc and listen for zero beat. 13. If it is determined, from previous steps, that RF output is present at J101 and if no zero beat is heard at J105, then the crystal calibrator circuit (V105) is defective. (See table 6–4, par. 11.)

TABLE 6–4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
NOTE: The carrier control (R173) and % MOD AUDIO OUT XTAL CAL OUT Control (R165) should always be turned fully counterclockwise before turning power on.	
1. VTVM CIRCUIT (V104). *a.* INOPERATIVE.	Measure the V104 tube socket voltages and resistances to ground, according to figure 6–15, "SIGNAL GENERATOR VOLTAGE AND RESISTANCE CHART", to locate defect.
b. METER (M101) ZERO ADJUSTMENT.	(1) The inability to zero set the meter can only be observed when S102 is in the CW or XTAL position. (2) If the meter cannot be zero adjusted (carrier control set to maximum counterclockwise position, power on) by means of the CARRIER METER ZERO (R127). *(a)* Replace 5276 (V104) tube. *(b)* Check DC voltage on R127 and R125. *(c)* Make checks suggested in 1 *(a)* above.
2. MODULATION CRYSTAL VOLTMETER INOPERATIVE.	*a.* The modulation metering circuit rectifies the modulation signal which is obtained from the output of V107 and read on the lower scale of the meter M101 when S102 is in the MOD position. If it is determined that this circuit is defective, replace CR101 and CR102. **Note** No zero set is necessary since germanium diodes do not have contact potential. *b.* If replacing CR101 and CR102 does not remedy the trouble, make continuity checks throughout the circuit.
3. BUFFER AND OUTPUT AMPLIFIER STAGES INOPERATIVE (V102, V103).	*a.* If preliminary tests have indicated that the buffer and output amplifier stages are inoperative, proceed with the following tests. *b.* Test DC voltages with the tubes (V102 and V103) in their respective sockets; M101 set for "10" and carrier frequency set to 100 kc. V102 Heater – 6.2v AC Plate Voltage – +187v DC Cathode Voltage – +1.6v DC Control Grid Voltage – 0 Screen Grid Voltage – +127v DC Suppressor Grid Voltage – 0 V103 Heater – 6.2v AC Plate Voltage – +187v DC Cathode Voltage – +1.6v DC Control Grid Voltage – 0 Screen Grid Voltage – +142v DC Suppressor Grid Voltage – 0 DC measurements made from socket terminals to chassis with a 20,000 ohms per volt voltmeter. *c.* If the voltages are correct, but the buffer-output amplifier is still inoperative, make a circuit continuity test with an ohmmeter until the defect is located. **Note** Check the tubes with a tube checker even though voltage checks are correct. Change in tube characteristics (e.g., transconductance, etc.) may not be shown in voltage checks but may actually be the source of trouble.

TABLE 6–4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE *(Continued)*

<table>
<tr><th>LOCATION AND TYPE OF TROUBLE</th><th>SUGGESTED METHOD FOR LOCALIZING TROUBLE</th></tr>
<tr><td>4. CARRIER OSCILLATOR (V101).
a. INOPERATIVE.</td><td>(1) If preliminary tests have indicated that the carrier oscillator is inoperative in all ranges, remove the signal generator from its cabinet and proceed with the following tests:
(a) Set the POWER switch (S103) in ON position and the frequency to 100 kc with the carrier oscillator tube (V101) in its socket, and test the tube voltages.
Heater Voltage: 6.2v AC.
Plate Voltage: Varies between 0 and 150v DC depending on setting of carrier control (R173). (Checking this may or may not cause circuit to stop oscillating.)
Grid Voltage: 0 to —0.5v DC (Varies with rotation of carrier control (R173).
Cathode Voltage: Varies between 0 and 0.5v DC.
(b) Turn the POWER switch (S103) to OFF position, remove the tube V101, and make the following resistance checks from grid to ground and grid to cathode, setting the frequency band switch knob (E119) to each corresponding position:
<table>
<tr><th>BAND</th><th>RESISTANCE (grid to ground)</th><th>RESISTANCE (grid to cathode)</th></tr>
<tr><td>A</td><td>1 megohm</td><td>1.047 megohm</td></tr>
<tr><td>B</td><td>470,000 ohms</td><td>492,000 ohms</td></tr>
<tr><td>C</td><td>390,000 ohms</td><td>408,000 ohms</td></tr>
<tr><td>D</td><td>120,000 ohms</td><td>126,800 ohms</td></tr>
<tr><td>E</td><td>47,000 ohms</td><td>48,000 ohms</td></tr>
<tr><td>F</td><td>22,000 ohms</td><td>22,470 ohms</td></tr>
<tr><td>G</td><td>10,000 ohms</td><td>10,000 ohms</td></tr>
<tr><td>H</td><td>4,700 ohms</td><td>4,700 ohms</td></tr>
</table>
(c) If the ohmmeter reads "open" in any position of the frequency band switch knob (E119), either the corresponding coil, grid resistor, or cathode resistor is open.
(d) If all voltage and continuity checks are correct, replace the tube and check results.</td></tr>
<tr><td>b. ERRATIC PERFORMANCE.</td><td>(1) Erratic performance of the carrier oscillator in a given band position is often difficult to trace. As a remedy, the following may be tried:
(a) Substitute a new tube.
Note
DO NOT DISTURB ADJUSTMENTS UNTIL POSITIVE TUBE IS NOT AT FAULT.
(b) Check for frequency band turret contacts.
(c) Check for dirty or a faulty carrier control (R173).
(d) Make visual inspection of main tuning capacitor (C123) for dirt, bent plates, etc.
(2) Make visual inspection of the oscillator coil for the range in question.</td></tr>
<tr><td>c. EXCESSIVE VOLTAGE NEEDED ON CARRIER CONTROL (R173).</td><td>(1) Often defects in the resonant system (oscillator coils, capacitors, and grid resistors) can be suspected if a greater than normal amount of plate voltage is necessary in order to develop the required voltage output.
(2) Check normal voltages between the slider (center lug) of the carrier (R173) and ground, in the following manner. (The carrier control should be set in the fully counterclockwise postion):
(a) POWER switch (S103) ON.</td></tr>
</table>

TABLE 6–4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE *(Continued)*

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
	(*b*) Carrier range switch (S101) to applicable range. (*c*) MOD, XTAL & METER SELECTOR switch (S102) at CW. (*d*) Main tuning dial (N102) set at beginning of all bands. (*e*) Oscillator plate voltages require for "10" meter reading. (1) Bands A through F – less than 100v DC. (2) Bands G and H – less than 150v DC.
5. MODULATION OSCILLATOR. *a.* INOPERATIVE ON BOTH 400 AND 1000 CYCLES.	(1) If it is indicated that the modulation oscillator is inoperative on both frequencies (400 and 1000 cycles), the probable defective part is some element common to both frequency positions of the MOD XTAL & METER SELECTOR switch (S102). (2) One possible trouble is too high a degree of degeneration. This degeneration is dependent upon the resistance ratio of R157 (degeneration control) and R159. Although the degeneration control (R157) is a locking type potentiometer, vibration may have changed its value. If its resistance is too small, the degeneration will be too great and oscillations will be inhibited. Sometimes increasing the resistance (R157) will assist the oscillator in breaking into oscillation. If this is the case, set this resistor at the point where oscillations just begin. (3) If a spare tube is available, it is sometimes most expedient to replace the old tube. (4) If replacing the tube does not solve the problem, continuity and voltage checks should be made. In making these voltage checks, refer to Table 6–5 TUBE OPERATING VOLTAGES AND CURRENTS.
b. INOPERATIVE ON ONLY ONE FREQUENCY (400 OR 1000 CYCLES).	(1) If the modulation oscillator is inoperative on only one frequency, the solution is relatively simple. (2) The defective element is probably one of the bridge resistors (R152, R153, R154 and R155). (3) Make the necessary resistance checks.
c. ERRATIC OPERATION OR PRESENCE OF AMPLITUDE DISTORTION.	(1) If the locking device on the degeneration resistor (R157) is loosened, mechanical vibration may cause a variation of resistance and hence degeneration. This may result in erratic operation or amplitude distortion. Check this control and tighten the locknut.
6. STEP ATTENUATOR (AT101). NOTE: Use Multimeter ME-25/U Series or equivalent for tests in Items *a*, *b*, and *c* below. *a.* NO OUTPUT ON ALL STEPS.	(1) If there is output from J101 but no output from J102 in all steps of AT101, the 500-ohm resistor (R130) may be burned out, or the coaxial cable of the attenuator may be open. (2) The following indirect check of R130 and the coaxial cable may be made from RF OUTPUT X-200K OPEN CIRCUIT jack J101 to ground; without removing the signal generator from its case. (*a*) Turn power switch S103 off. (*b*) Place the output/range switch S101 to X200K position. (*c*) Set the RF MULTIPLIER (AT101) to the X10K step. (*d*) Under the above conditions the normal resistance from J101 to ground is 655-ohms. (3) The resistance of the 500-ohm resistor R130 (see figure 6–6) may be measured, without unsoldering, by placing the ohmmeter test leads directly across it. (4) Continuity of the coaxial cable leads to AT101 may be determined by disconnecting it at jack J103 and measuring the resistance from the center pin of the BNC plug (UG-88/U) to ground. The resistance should be 55.5 ohms.

TABLE 6—4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE *(Continued)*

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE

PIN	CORRECT	CRYSTAL (Y101) DEFECTIVE	TUBE (V105) DEFECTIVE (NOT CONDUCTING)
1	—0.5v DC	—0.2v DC	0
2	approx. 0.1	approx. 0.1	0
3	0		0
4	6.2v AC	6.2v AC	0 if heater is shorted 6.2v AC if heater is not shorted
5	90v DC	8v DC	190v DC
6	82v DC	45v DC	190v DC
7	2.8v DC	0.25v DC	0

b. FREQUENCY CALIBRATION.

(1) Provision is made for calibrating the 1 mc frequency of the crystal calibrator, if it is suspected that its accuracy has fallen off in excess of ±0.05%. The calibration should be accomplished in the following manner:

(*a*) Remove RF Signal Generator SG-111/URM-25E (See par. 8.*a* of this section).

(*b*) Connect the signal generator unit to Power Supply PP-1205/URM-25E.

(*c*) Tune a receiver, such as Navy Model RBC series to the 5 mc signal of Navy Station WWV.

(*d*) Turn the signal generator on and the CARRIER CONTROL fully counterclockwise.

(*e*) Turn MOD XTAL & METER SELECTOR switch (S102) to XTAL position. Connect a lead from the RF OUTPUT X-200K jack J101 to the antenna input on the RBC. Sufficient crystal output will be available at J101 to drive the receiver.

(*f*) With the receiver tuned to WWV, adjust crystal frequency adjusting capacitor (C158) (figure 6—9) for the zero beat (fifth harmonic of 1 mc crystal) against WWV. A set of earphones or speaker can be used for monitoring this beat.

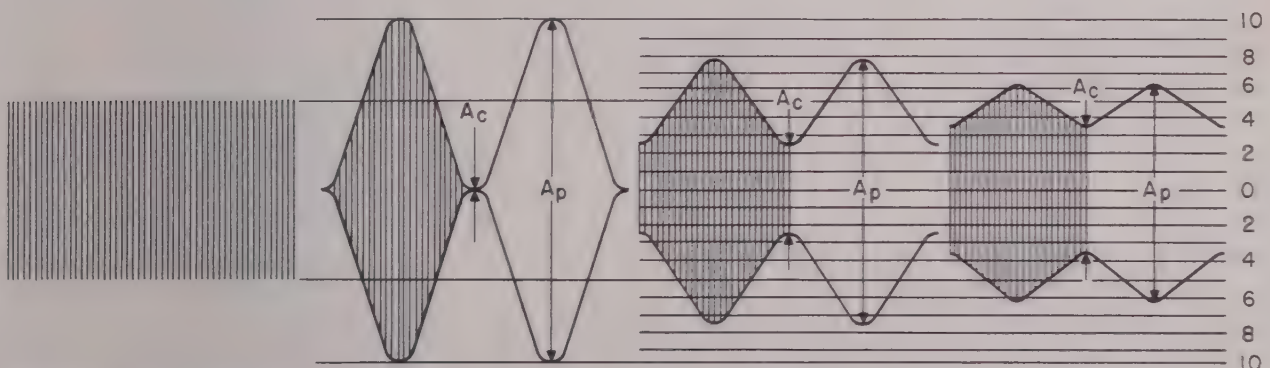
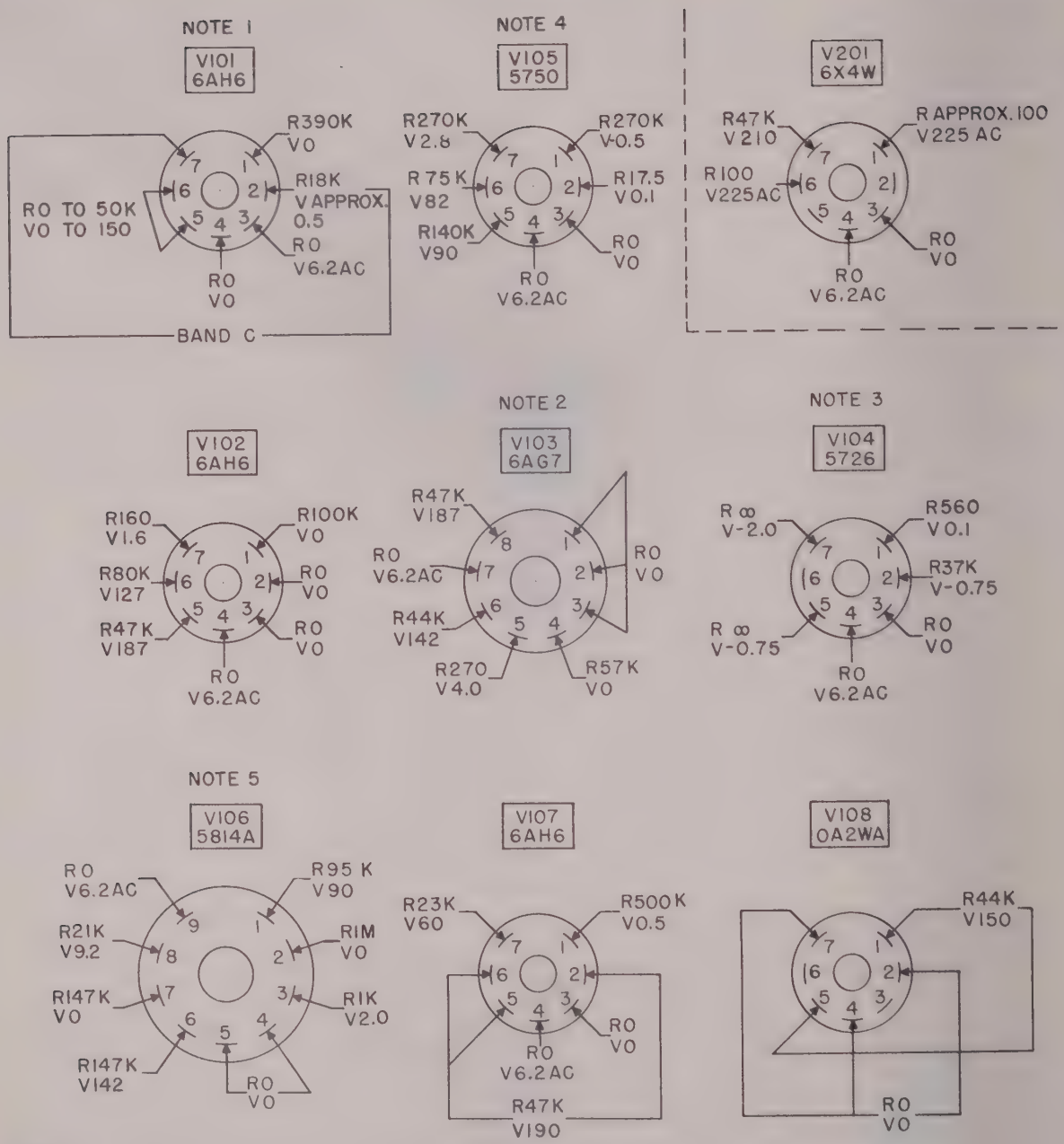


Figure 6—14. Percentage Modulation Chart



NOTES:
READINGS MADE WITH SIGNAL GENERATOR SET IN FOLLOWING OPERATING CONDITIONS:
1. BAND "C" OPERATION (95-300KC)
2. S102 SWITCH IN CRYSTAL OR CW POSITION
3. CAUTION: DO NOT MEASURE RESISTANCE FROM PINS 5 OR 7 TO GROUND WITH S102 IN CRYSTAL OR CW POSITION, HOWEVER, VOLTAGE READINGS WERE TAKEN WITH S102 IN CW POSITION, M101 SET TO 10MV, AND FREQUENCY SET TO 10 KC
4. S102 IN CRYSTAL POSITION
5. S102 IN 1000 CYCLE POSITION
RESISTANCE AND VOLTAGE MEASUREMENTS MADE BETWEEN TEST POINTS AND GROUND.
ALL DC READINGS TAKEN WITH A 20,000 OHMS/VOLT METER.
ALL AC READINGS TAKEN WITH A 1,000 OHMS/VOLT METER.

Figure 6–15. Signal Generator Voltage and Resistance Chart

TABLE 6–4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE *(Continued)*

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
b. NO OUTPUT ON ONE OR MORE, BUT NOT ALL STEPS.	(1) One of the step attenuator series resistors, R132, R134, R136, R138, R140 is burned out. This may be determined without removing the signal generator from its case as follows: (*a*) Place the output/range switch (S101) to X-MULT position. (*b*) Make sure POWER switch (S103) is turned off. (*c*) Make connection to RF OUTPUT X-MULT jack (J102). Use a short length of coaxial cable and a BNC plug type UG-88/U for this connection. (*d*) If one of the series resistors R134, R136, R138 and R140 is open the reading obtained to ground on two successive positions will be 55-ohms instead of the normal 50-ohms. For example, if series resistor R138 is open, the readings obtained on steps X10 and X1 will be 55-ohms. If the series resistor R132 is open, the reading on X10K and X1K will be 61.8 and 55-ohms respectively.
c. APPROXIMATELY 2:1 INSTEAD OF 10:1 ATTENUATION BETWEEN TWO SUCCESSIVE STEPS.	(1) One of the step attenuator shunt resistors (R133, R135, R137 and R139) is probably burned out. (2) Check the resistance at J102 to ground. If one of the above shunt resistors is open a reading of 275-ohms to ground at any of the respective positions: X1K, X100, X10, X1 will indicate that defective resistor (see figure 2–5). (3) If one of the shunt resistors R131 or R141 is open, the readings obtained at X10K or X.1 positions, respectively, will be 550-ohms.
d. REPLACING STEP ATTENUATOR RESISTORS.	(1) Recalibrate step attenuator ratios for range in which resistor was replaced, using (10:1) Fixed Attenuator CN-283/U and a radio receiver such as Navy Model RBA series or equivalent. Follow the procedure outlined in Section 6, paragraph 19. **CAUTION** Resistance measurements at J102 should be made with a resistance bridge such as Resistance Bridge ZM-4/U, or equivalent, to avoid burning out one of the step attenuator resistors. If the electronics technician uses an ordinary ohmmeter, great care must be exercised to see that this ohmmeter does not place a current in excess of 20 milliamperes through the attenuator circuit while testing. Any repairs to the attenuator should be made by qualified technicians.
7. POWER SUPPLY PP-1205/URM-25E. *a.* INOPERATIVE.	(1) Check line fuses F101 and F102. (2) With an ohmmeter check interconnecting cables W103 and W108 for continuity. (3) Check power transformer (T201). (4) If no B+, check rectifier tube V201, filter choke L201 and series resistor R201.
b. OVERHEATING.	(1) Check for short circuited turns on T201. (2) Check for partial breakdown of C201, C202, and C203. It is sometimes best to replace one or all of these capacitors, if it is suspected that one of them is defective. A voltage or ohmmeter check will not always identify this trouble.
c. LOSS OF REGULATION.	(1) Check with a variac or variable voltage source. Change the line voltage from 103v to 126v AC. The +150v DC output should not change. This does not apply to the unregulated +220v DC supply. (2) Replace regulator tube (V108) if the B+ does not remain steady at 150v DC.
8. HUM MODULATION.	*a.* Listen for power line hum (impressed on carrier frequency) or check output on scope.

TABLE 6–4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE *(Continued)*

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
	b. Check for unshielded leads between signal generator and receiver. All leads between these units should be shielded. *c.* Check for mechanical vibrations of T201. Tightly secure the transformer mounting. *d.* Change the oscillator tube (V101).
9. ACCESSORY UNITS. *a.* IMPEDANCE MATCHING NETWORK CU-410/URM-25E. *b.* IMPEDANCE MATCHING NETWORK CU-411/URM-25E. *c.* DUMMY LOAD DA-106/URM-25E. *d.* (5:1) FIXED ATTENUATOR CN-285/U. *e.* (10:1) FIXED ATTENUATOR CN-283/U. *f.* TEST LEAD CX-2962/U.	If it is suspected that any one of these accessory units is defective, a simple continuity check will readily indicate the source of trouble. **CAUTION** When making a resistance check on the Impedance Matching Network CU-410/URM-25E or CU-411/URM-25E, be sure the lowest ohmmeter resistance range is used. Ohmmeters with internal batteries larger than 1.5v may burn out the resistor in these units. Where greater accuracy is desired, resistance measurements should be made with Resistance Bridge ZM-4/U or equivalent.
10. OUTPUT CABLES.	Check leakage resistance with a megger (high resistance ohmmeter) such as the AN/PSM-2.
11. CRYSTAL CALIBRATOR (V105).	If the check in Table 6–3 under CRYSTAL CALIBRATOR indicates that this unit is defective, the following tests should be made to localize the trouble. **Note** The output beat of the crystal calibrator is amplified by both sections of the beat note amplifier (V106) and the cathode follower (V107). Make sure that these stages are functioning (Table 6–3, under MODULATION OSCILLATOR) before deciding that the V105 circuit is defective. *a.* Replace crystal (Y101), then tube V105 if available. These parts are the most common source of trouble in the crystal calibrator. *b.* Check V105 in a tube tester and substitute a new tube if necessary. *c.* Make circuit continuity and voltage test. Figure 6–15 indicates the normal socket to ground voltages and resistances for V105. The following readings from socket pins to ground indicate that either the tube V105 or crystal Y101 is defective. Measurements should be made with a 20,000 ohm/DC and 1000 ohm/VAC meter.

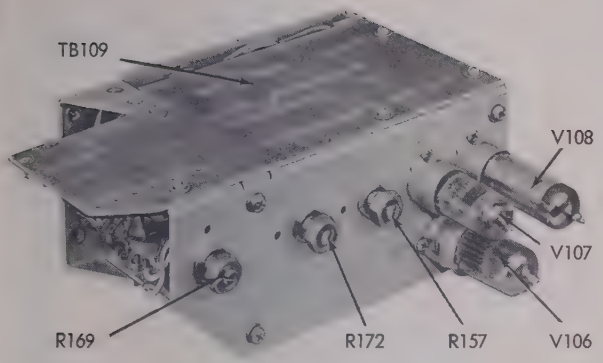


Figure 6—16. Exterior View of Audio and Metering Circuit

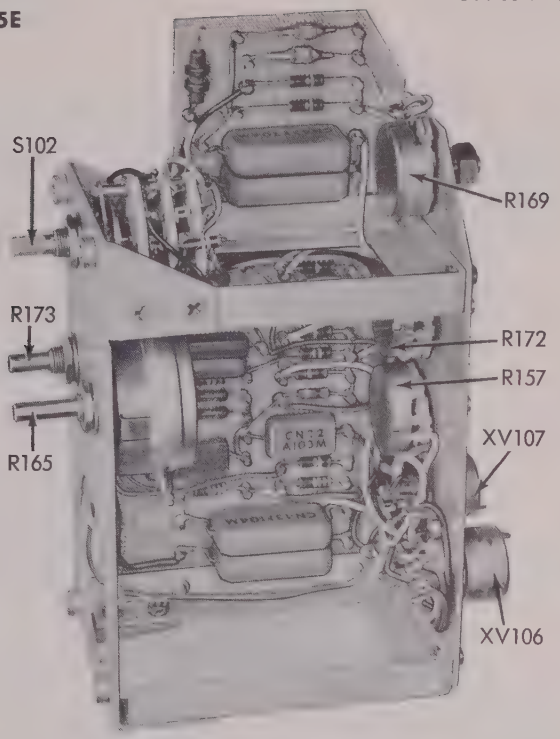


Figure 6—17. Interior View of Audio and Metering Assembly Showing Terminal Board and Position of Components

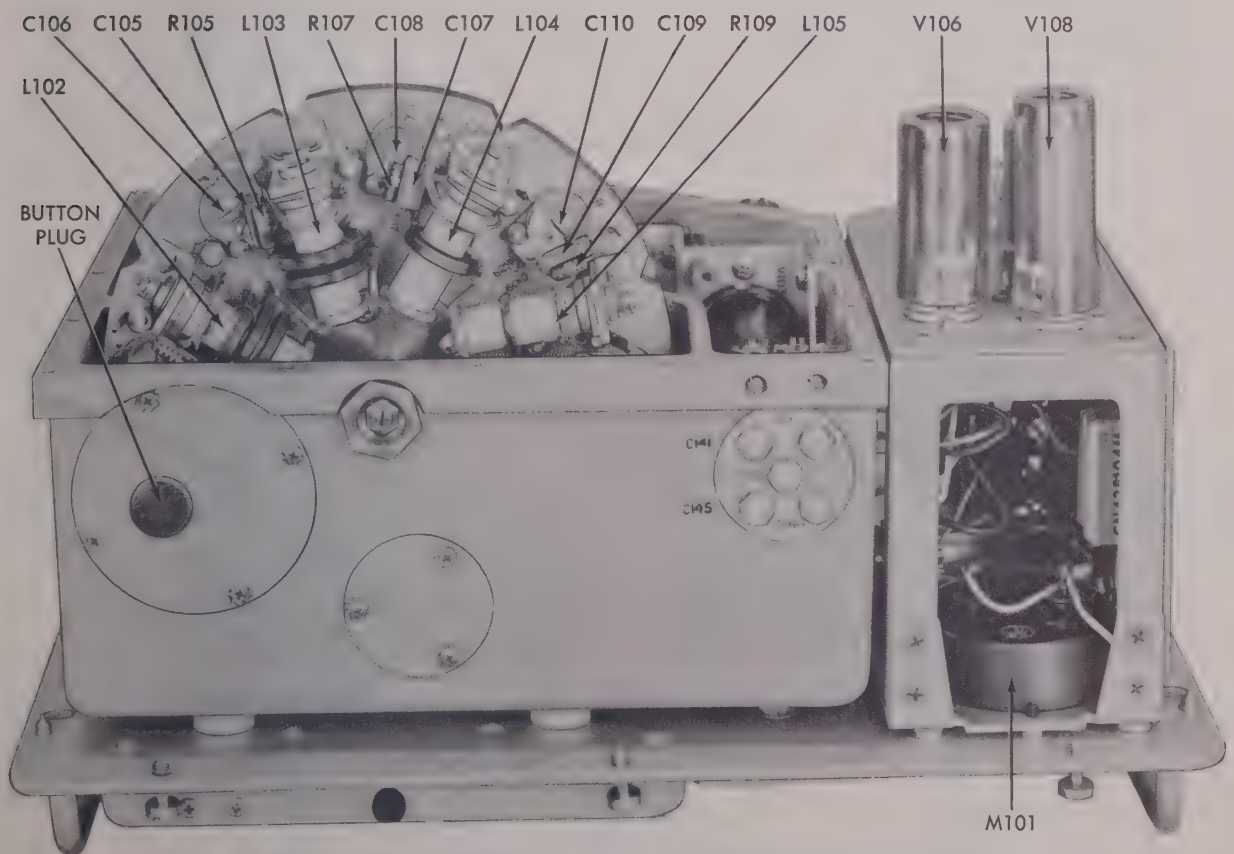


Figure 6—18. Top View of Signal Generator SG-111/URM-25E

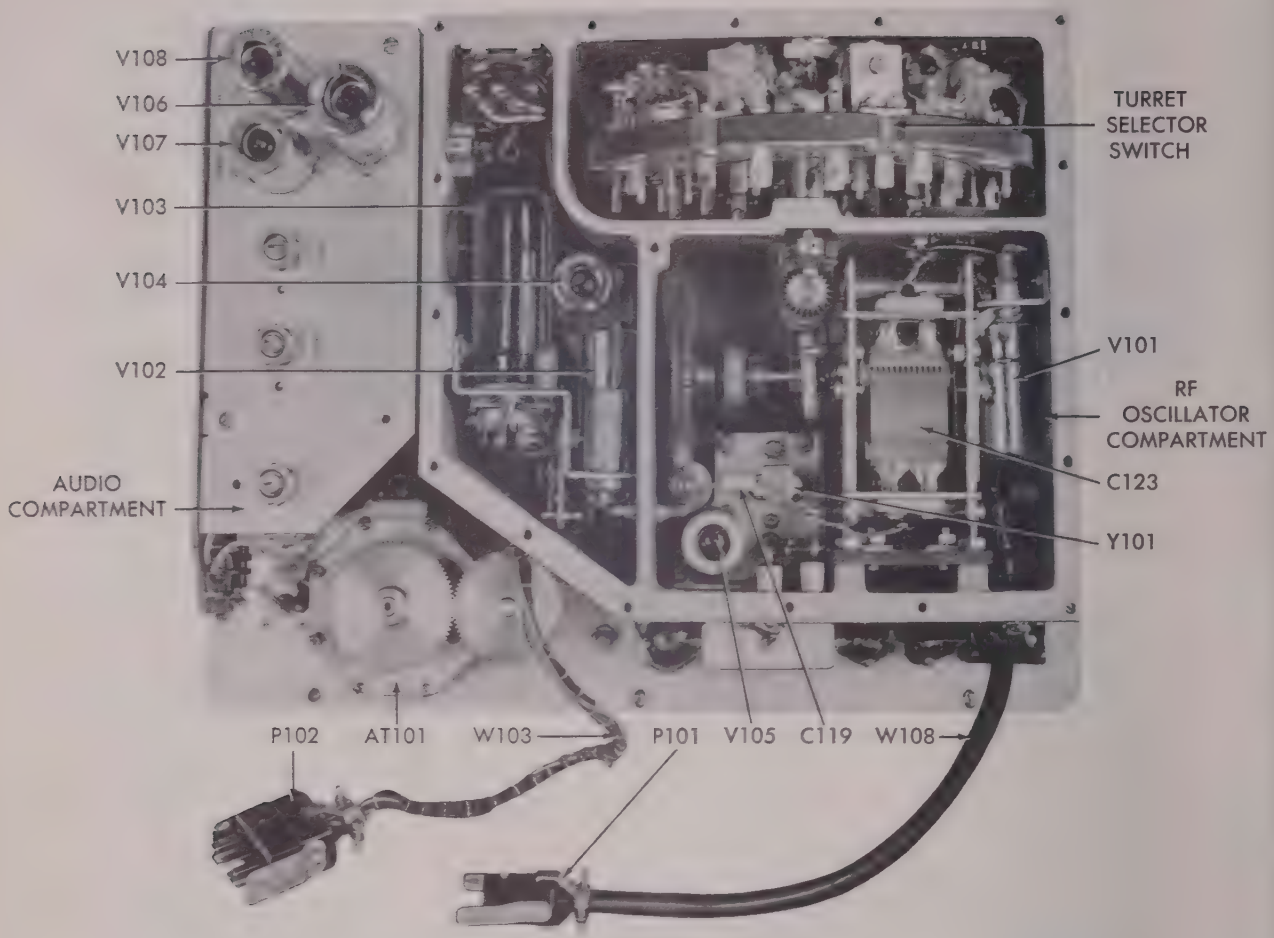


Figure 6–19. Rear View of Signal Generator SG-111/URM-25E

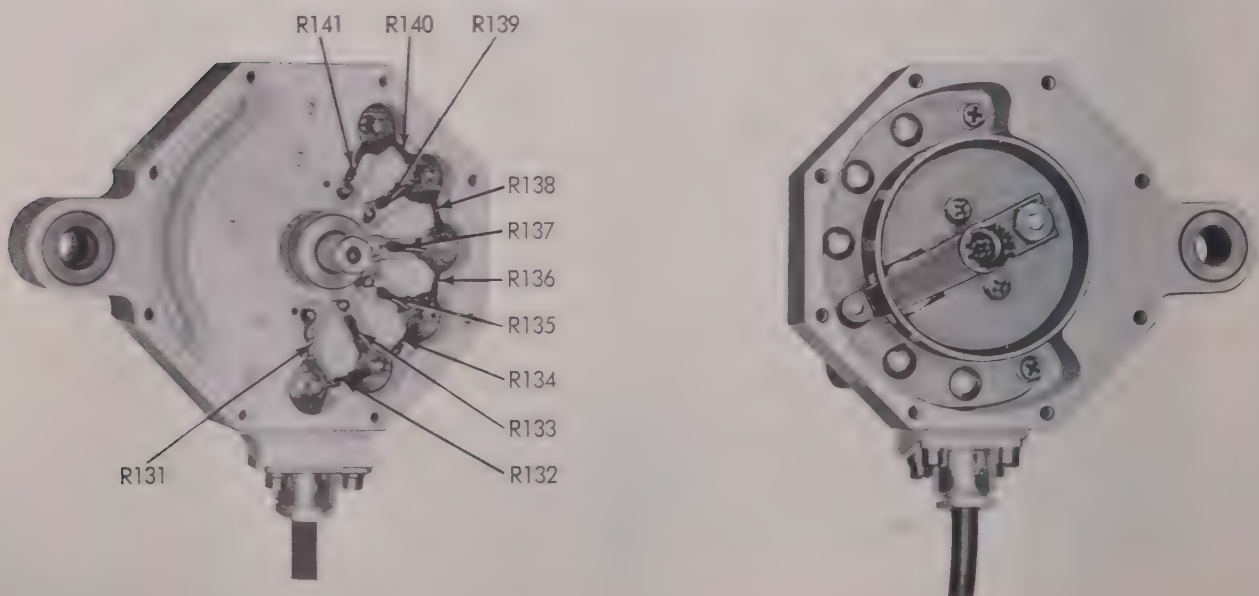
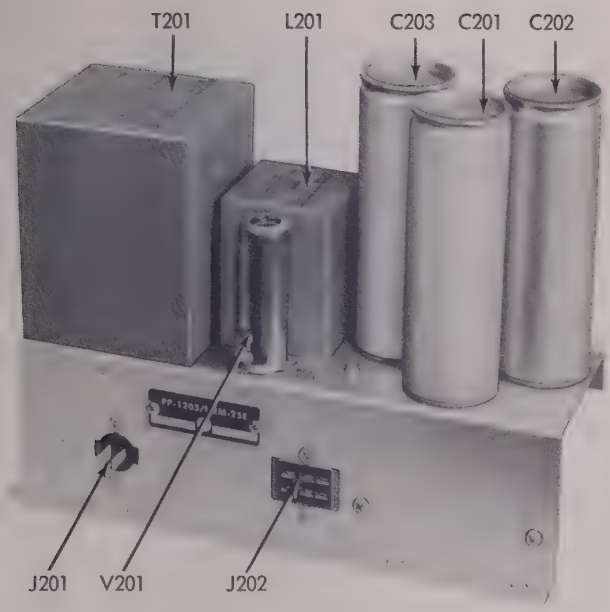


Figure 6–20. Top and Bottom Interior Views of Step Attenuator (AT101)



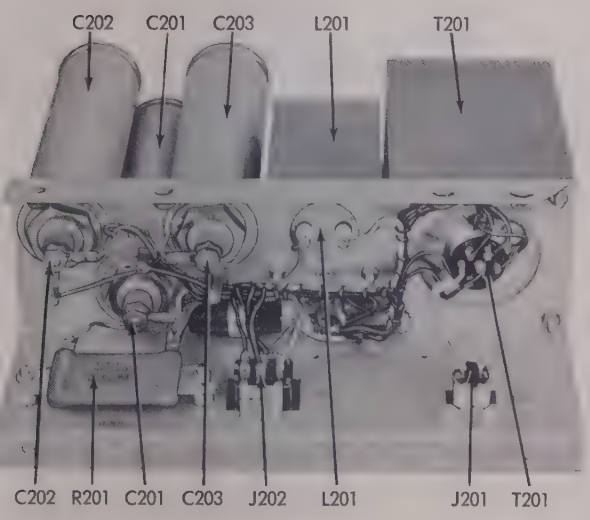


Figure 6—21. Top and Bottom Views of Power Supply PP-1205/URM-25E

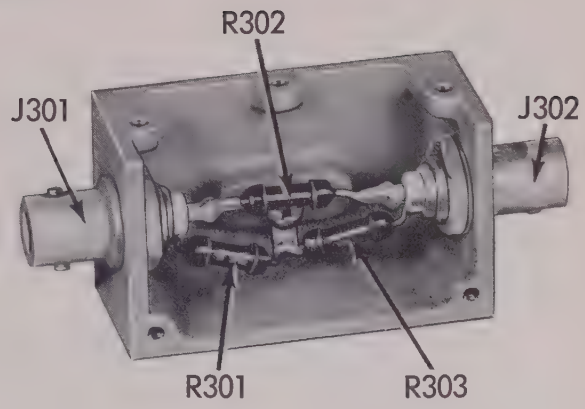


Figure 6—22. Interior View of (5:1) Fixed Attenuator CN-284/U

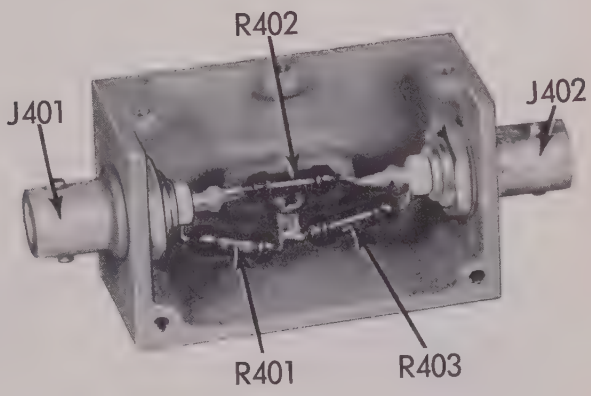


Figure 6—23. Interior View of (10:1) Fixed Attenuator CN-283/U

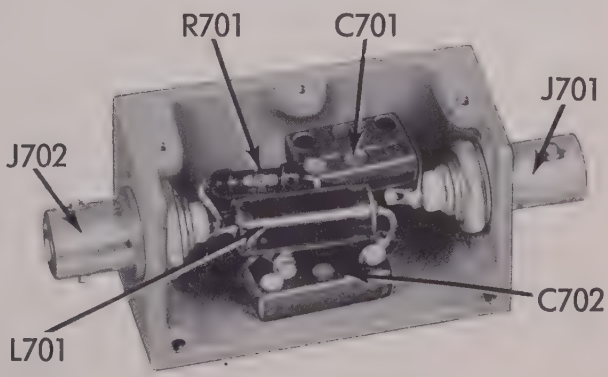


Figure 6—24. Interior View of Dummy Load DA-106/URM-25E

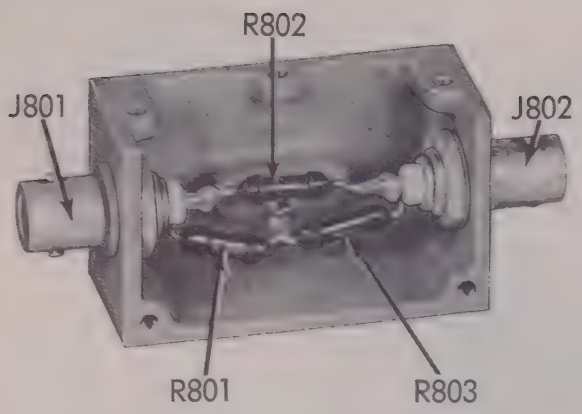


Figure 6—25. Interior View of Impedance Matches Network CU-410/URM-25E

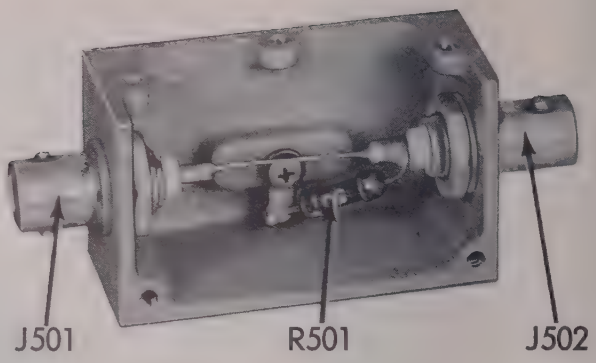


Figure 6—26. Interior View of Impedance Matching Network CU-411/URM-25E

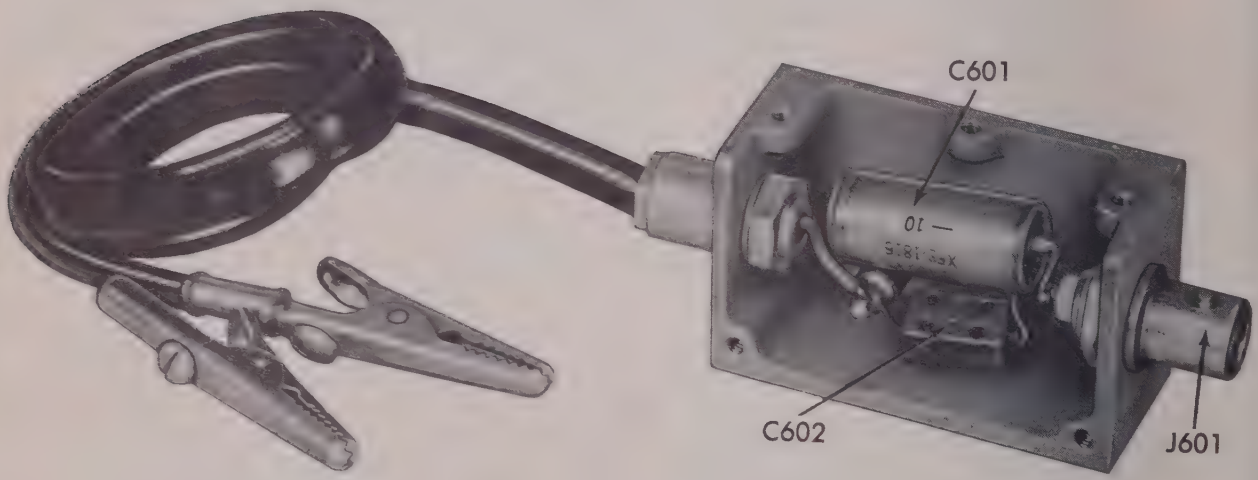


Figure 6—27. Test Lead CX-2962/U

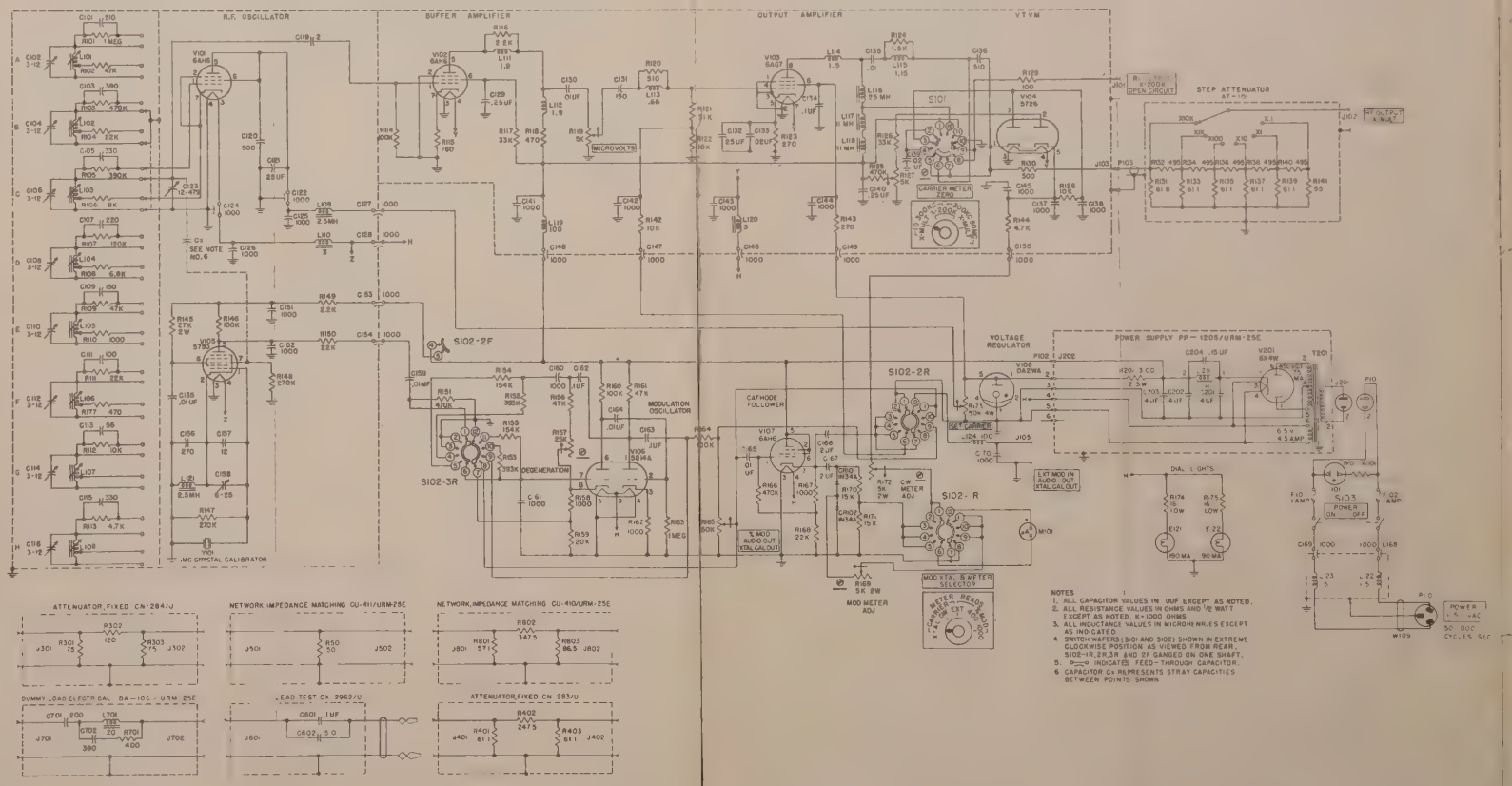

R.F. OSCILLATOR
BUFFER AMPLIFIER
OUTPUT AMPLIFIER
VTVM
STEP ATTENUATOR AT-101
MICROVOLTS
CARRIER METER ZERO
S101
S102-2F
S102-3R
S102-2R
S102-R
MODULATION OSCILLATOR
CATHODE FOLLOWER
VOLTAGE REGULATOR
POWER SUPPLY PP-1205/URM-25E
DEGENERATION
SET CARRIER
CW METER ADJ
MOD METER ADJ
MOD XTAL & METER SELECTOR
EXT MOD IN AUDIO OUT XTAL CAL OUT
% MOD AUDIO OUT XTAL CAL OUT
DIAL LIGHTS
S103 POWER ON OFF
SEE NOTE NO. 6
MC CRYSTAL CALIBRATOR
ATTENUATOR, FIXED CN-284/U
NETWORK, IMPEDANCE MATCHING CU-411/URM-25E
NETWORK, IMPEDANCE MATCHING CU-410/URM-25E
DUMMY LOAD ELECTRICAL DA-106/URM-25E
LEAD TEST CX-2962/U
ATTENUATOR, FIXED CN-283/U
NOTES
1. ALL CAPACITOR VALUES IN UUF EXCEPT AS NOTED.
2. ALL RESISTANCE VALUES IN OHMS AND 1/2 WATT EXCEPT AS NOTED. K=1000 OHMS
3. ALL INDUCTANCE VALUES IN MICROHENRIES EXCEPT AS INDICATED
4. SWITCH WAFERS (S101 AND S102) SHOWN IN EXTREME CLOCKWISE POSITION AS VIEWED FROM REAR. S102-1R, 2R, 3R AND 2F GANGED ON ONE SHAFT.
5. o—o INDICATES FEED-THROUGH CAPACITOR.
6. CAPACITOR C6 REPRESENTS STRAY CAPACITIES BETWEEN POINTS SHOWN

Figure 6-28. RF Signal Generator Set AN/URM-25E, Overall Schematic Diagram

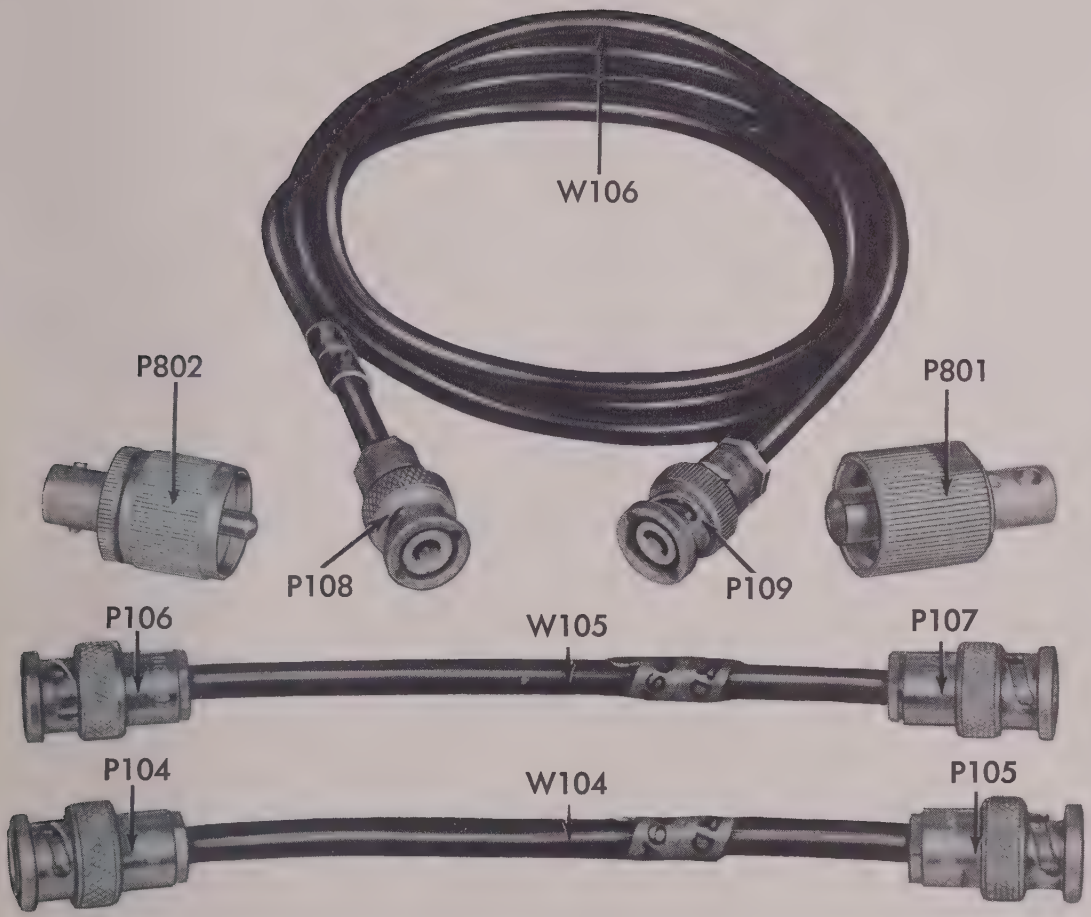


Figure 6—29. RF Cable Assemblies and Connectors

TABLE 6–5. TUBE OPERATING VOLTAGES AND CURRENTS

SYMBOL NUMBER	TUBE TYPE	FUNCTION	PLATE P (E)	PLATE (MA)	SCREEN (E)	SCREEN (MA)	SUPPRESSOR (E)	CATHODE (E)	GRID (E)	HEATER VAC
V101	6AH6	Carrier Oscillator	0 to 150	0 to 0.9	Connected to plate	....	0.5[2]	Approx. 0.5[2]	Approx. 0	6.2
V102	6AH6	Buffer Amplifier	187	8.5	127	2.0	0	1.6	0	6.2
V103	6AG7	Output Amplifier	187	12	142	3.0	0	4.0	0	6.2
V104A	5726	VTVM Compensator	Pin 2[2] 0.1 to —.85	0.45[2]	....	....	....	Pin 1[2] 0 to 0.1	....	6.2
V104B	5726	VTVM Rectifier	Pin 7[2] —41 to —2.1	0.38	....	....	....	Pin 5[2] 0 to —0.8	....	6.2
V105[5]	5750	Crystal Calibrator	90[3]	1.0[3]	82[3]	3.5[3]	0.1[3]	0	—0.5[3]	6.2
V106A	5814A	Modulation Oscillator	Pin 1[4] 90	2.0	....	....	. . .	Pin 3[4] 2.0	Pin 2[4] 0	6.2
V106B	5814A	Modulation Oscillator	Pin 6[4] 142	0.5[4]	....	....	....	Pin 8[4] 9.2	Pin 7[4] 0	6.2
V107	6AH6	Modulation Amplifier	190	2.8	190	....	190	60[4]	0.5[4]	6.2
V108	OA2WA	B+ Regulator	150	20 to 10	....	....	....	0	....	....
V201	6X4W	Rectifier	225V AC	. . .	....	....	....	210	....	6.2

NOTES: All measurements made with a 20,000 ohm/volt DC and 1000 ohm/volt AC meter with the Signal Generator set in the following operating condition:

(1) Band "C" operation.

(2) S102 switch in "CW" position & M101 set to 10.

(3) S102 switch in "Crystal" position.

(4) S102 switch in 400 or 1000 cycle position. Set for 30% modulation.

(5) Pin 7 of 5750 (injector grid) = 2.8V DC.

TABLE 6–6. RATED TUBE CHARACTERISTICS

TUBE TYPE	FILAMENT VOLTAGE (V)	FILAMENT CURRENT (A)	PLATE VOLTAGE (V)	GRID BIAS (V)	SCREEN VOLTAGE (V)	PLATE CURRENT (MA)	SCREEN CURRENT (MA)	A-C PLATE RESISTANCE (OHMS)	VOLTAGE AMPLIFICATION (MU)	TRANSCONDUCTANCE (MICROMHOS)		EMISSION	
										NORMAL	MINIMUM	IS(MA)	TEST VOLT
OA2WA	. . .	.	150	. .	. . . .	5—30	. . . .	. . .	. . . .	. . . .	.		
6AG7	6.3	0.65	375	—75	250	30	9.0	. . .	. . .	.	. . . .		
6AH6	6.3	0.45	300	160	150	10	2.50	500,000	. .	9000	. . . .		
6X4W	6.3	0.60	325	. . . .	. . .	210	. . . .	. . .	.	. . . .	. . . .		
5726	6.3	0.30	117	. . .	. .	. . . .	. . . .	. . . .	. . .	. .	. . .		
5750	6.3	0.30	250	—1.5	100	2.6	7.5	1 Meg.	. .	Conversion 475	. . .		
5814A	12.6	.175	250	—8.5	. . . .	26	.	1800	43	24000	. . .		

RATED GERMANIUM CRYSTAL DIODE CHARACTERISTICS

TYPE	MAX. INVERSE VOLTS	PEAK RECTIFIED MA.	MAX. SURGE MA.	MAX. REVERSE u-Amp.	MAX. AVERAGE MA.
IN34A	60	150	500	800 @ 50V	40

TABLE 6–7. WINDING DATA

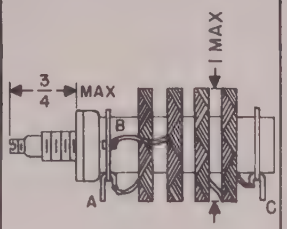
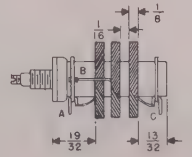
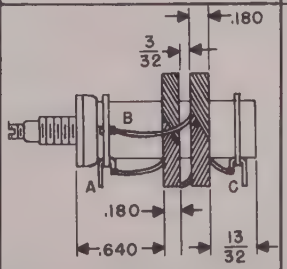
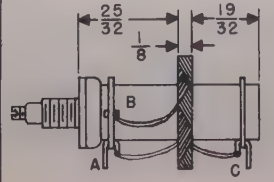
SYMBOL DESIG.	HARVEY-WELLS PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	INDUCTANCE	REMARKS
L101	B-12N1006-501		Universal 4 equal pies	40 SSE	5310	1065	590 mh at 25 kc	Inductance measured without slug L101 to L108
L102	B-12N1004-501		Universal 3 equal pies	40 SNE	1950 turns tapped at 850 turns	430	47 mh at 79 kc	Tap measured from start of winding
L103	B-12N1009-501		Universal 2 equal pies	36 DNE	600 turns tapped at 375 turns	55	4.7 mh at 250 kc	All R.F. coils coated with MFP varnish per MIL-V-173A Class I
L104	B-12N1007-501		Universal	36 DNE	160 turns tapped at 85 turns	12.7	500 uh at 790 kc	Coils close wound unless specified otherwise

TABLE 6–7. WINDING DATA *(Continued)*

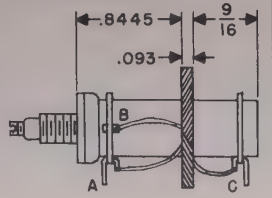
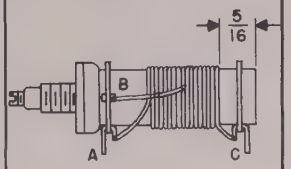
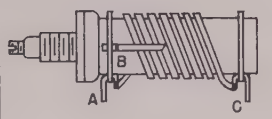
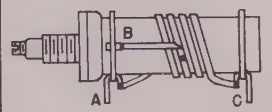
SYMBOL DESIG.	HARVEY-WELLS PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	INDUCTANCE	REMARKS
L105	B-12N1008-501		Universal	36 DNE	48 turns tapped at 37 turns	3.4	52 uh at 2.5 mc	
L106	B-12N1005-501		Single layer 44 turns per inch	30 EN	20 turns tapped at 10 turns	0.3	4.1 uh at 7.9 mc	
L107	B-12N1010-501		Single layer 10 turns per inch	.062 in. w silver strip .005 in. thk	7 turns tapped at 3 turns	—	0.375 uh at 25 mc	
L108	B-12N1011-501		Single layer 7 turns per inch	.062 in. w silver strip .005 in. thk	4 turns tapped at 2 turns	—	0.157 uh at 25 mc	

TABLE 6–7. WINDING DATA *(Continued)*

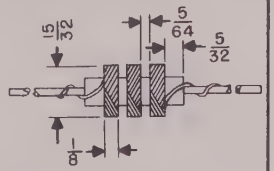
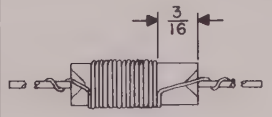
SYMBOL DESIG.	HARVEY-WELLS PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	INDUCTANCE	REMARKS
L109 L116 L121	B-12B1021-501		Universal 3 equal pies	36 SNE	429	18.3	2.5 mh at 250 kc	
L110 L120	B-12B1018-501		Single layer	28 E	14½	—	3.0 uh at 7.9 mc	
L111 L112	B-12A1030-501		Single layer	36 SNE	44	—	1.9 uh at 7.9 mc	
L113	B-12A1030-502		Single layer	36 SNE	17	—	0.68 uh at 25 mc	

TABLE 6–7. WINDING DATA *(Continued)*

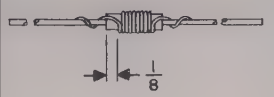
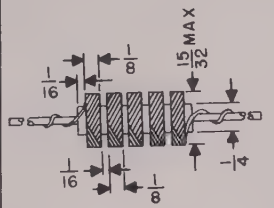
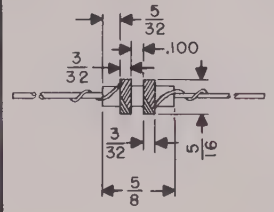
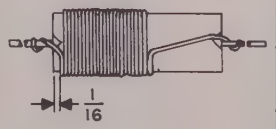
SYMBOL DESIG.	HARVEY-WELLS PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	INDUCTANCE	REMARKS
L114	B-12A1030-503		Single layer	36 SNE	34	——	1.5 uh at 7.9 mc	
L115	B-12A1030-504		Single layer	36 SNE	27	——	1.15 uh at 7.9 mc	
L117 L118	B-12B1020-501		Universal 5 equal pies	40 SNE	1035	108.8	11 mh at 79 kc	
L119 L124	B-12A1029-501		Universal 2 equal pies	38 SNE	180	8.9	100 uh at 790 kc	

TABLE 6–7. WINDING DATA *(Continued)*

SYMBOL DESIG.	HARVEY-WELLS PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	INDUCTANCE	REMARKS
L122 L123	B-12A1031-501		Single layer 90 turns/in.	32 E	15	0.2	1.5 uh at 7.9 mc	
L201	C-12B1017-1		Single winding (1-2)	35 E	3260½	400	11 h at 75 ma dc, 30 V 60 cycles	
L701	B-12B1019-501		Single layer	30 E	48	—	20 uh at 2.5 mc	
T201	C-9A1021-1		Primary (1-2) Plate (3-4-5) Filament (6-7)	24 33 18	455 1940 28	5.4 225 0.06	— — —	115V 50-1000 cycles 450 VCT 75 ma dc 6.5 V 4.5 A

SECTION 7

PARTS LIST

Table 7–1 List of Major Units

Table 7–2 Table of Replaceable Parts

Table 7–3 Cross Reference Parts Lists

Table 7–4 Applicable Color Codes and Miscellaneous Data

Table 7–5 List of Manufacturers

TABLE 7–1. LIST OF MAJOR UNITS

SYMBOL GROUP	QUANTITY	NAME OF MAJOR UNIT	NAVY TYPE OF A-N DESIGNATION
101 to 199	1	Generator, Signal	SG-111/URM-25E
	1	Cover, Signal Generator	CW-355/URM-25E
201 to 299	1	Power Supply	PP-1205/URM-25E
301 to 399	1	Attenuator, Fixed (5:1)	CN-284/U
401 to 499	1	Attenuator, Fixed (10:1)	CN-283/U
501 to 599	1	Network, Impedance Matching	CU-411/URM-25E
601 to 699	1	Lead, Test	CX-2962/U
701 to 799	1	Dummy Load, Electrical	DA-106/URM-25E
801 to 899	1	Network, Impedance Matching	CU-410/URM-25E
W106	1	Cable Assembly, R.F.	CG-409/U (4')
W104 & W105	2	Cable Assembly, R.F.	CG-409/U (6")
P801	1	Connector Adapter	UG-201/U
P802	1	Connector Adapter	UG-273/U

TABLE 7—2. TABLE OF REPLACEABLE PARTS

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
		GENERATOR, SIGNAL: Navy type SG-111/URM-25E; contractors Pt #D-90B1500-501 less D-90B1479-501.	
A101	# —	PLATE, COVER: Aluminum, anodized; .064 in. thk, 1.531 in. dia; three .136 in. dia holes on 1.250 in. dia mtg/C located 120° apart; .453 in. dia center hole; four .113 in. dia holes on .500 in. x .500 in. mtg/C; CWV Pt #B-81D1467-2.	RF shield
A102	# —	PLATE, DETENT: Stainless steel, passivate; 1.438 in. dia, .156 in. thk; .914 in. dia center hole; three .128 in. dia holes with .225 in. dia by 82° countersink located 67° apart on .588 in. radius; six .093 in. dia holes with .156 in. dia by 60° countersink located 30° apart on .547 in. radius; CWV Pt #A-81D1480-1.	Step attenuator detent
A103	# —	COVER, DIAL: Aluminum anodized; 7¼ in. lg by 6¼ in. w by ⅝ in. dp; four .159 in. dia holes on 5.625 in. by 6.625 in. mtg/C; two sets of four .136 in. dia holes on 1.312 in. by 1.875 in. mtg/C; one 1 in. dia center hole; two cutouts for viewing frequency dial; CWV Pt #C-81D1422 Sh. 1 & 2.	Protective cover for frequency scale dial
A104	# —	DISC, COVER: Aluminum, anodize; .040 in. thk, 2½ in. dia; four .125 in. dia mtg holes, spaced 90° apart on 2.250 in. dia mtg/C; one ½ in. hole located 21/64 in. from center; CWV Pt #A-81D1448-1.	RF shield
A105	# —	COVER, R.F. ATTENUATOR: Aluminum, anodized; octagon shape; ⅛ in. thk; .516 in. dia center hole; eight .128 in. dia holes spaced 45° apart. CWV Pt #A-81D1459-1.	Step attenuator cover
A106	# —	CLAMP, CRYSTAL: Phosphor bronze, nickel plate; ⅜ in. w, .020 in. thk; multiple bends; 1.270 in. h x 1 in. lg o/a. CWV Pt #A-51G1034-1.	Retainer for Y101
A107	# —	PLATE, COVER: Aluminum, anodized; .064 in. thk, 1.531 in. dia; three .136 in. dia holes on 1.250 in. dia mtg/C located 120° apart. CWV Pt #B-81D1467-1.	RF shield
A108	# —	COVER & POST ASSEMBLY: CWV Pt #D-90B1407-501.	Protective cover for front panel
AT101	N16-AO98026-4416 —	ATTENUATOR: Step unbalanced ladder network; output 50 ohms; aluminum case; 8 sides 2 7/16 in. across flats x 23/32 in. thk o/a excluding connector and shaft; gear driven steel shaft; 6 steps, 20 db per step; RF coaxial cable (RG-58C/U) input; BNC connector output; four #4-40, NC-2 mtg holes 90° apart 1¾ in. dia. CWV Pt #C-90B1492-501.	Output voltage attenuator
C101	N16-C-30188-3635 3K1551122	CAPACITOR, FIXED, MICA: JAN type CM15B511J; single section; 510 uuf ±5%; 300 vdcw; characteristic ltr B; 9/32 in. lg x ½ in. w x 3/16 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V101 Grid blocking capacitor Band A
C102	N16-C-63934-8129 3D9012V-19	CAPACITOR, VARIABLE, CERAMIC: JAN type CV11A120; rotary type; single section; 3.0 uuf to 12.0 uuf; 500 vdcw; temp coeff ltr A; 27/32 in. lg x 41/64 in. w x 13/32 in. h excl term; two solder lug term; two .120 in. dia holes on .438 in. mtg/C; screwdriver adj; ceramic base; per JAN-C-81.	Carrier oscillator Band A trimmer
C103	N16-C-29903-2862 3K1539121	CAPACITOR, FIXED, MICA: JAN type CM15B391K; single section; 390 uuf ±10%; 300 vdcw; characteristic ltr B; 9/32 in. lg x ½ in. w x 3/16 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V101 Grid blocking capacitor Band B

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

C104		Same as C102.	Carrier oscillator Band B trimmer
C105	N16-C-29718-5792 3K1533121	CAPACITOR, FIXED, MICA: JAN type CM15B331K; single section; 330 uuf ±10%; 300 vdcw; characteristic ltr B; 9/32 in. lg x 1/2 in. w x 3/16 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V101 Grid blocking capacitor Band C
C106		Same as C102.	Carrier oscillator Band C trimmer
C107	N16-C-29375-6450 3K1522121	CAPACITOR, FIXED, MICA: JAN type CM15B221K; single section; 220 uuf ±10%; 300 vdcw; characteristic ltr B; 9/32 in. lg x 1/2 in. w x 3/16 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V101 Grid blocking capacitor Band D
C108		Same as C102.	Carrier oscillator Band A trimmer
C109	N16-C-28979-9450 3D9150-117	CAPACITOR, FIXED, MICA: JAN type CM15B151K; single section; 150 uuf ±10%; 300 vdcw; characteristic ltr B; 9/32 in. lg x 1/2 in. w x 3/16 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V101 Grid blocking capacitor Band E
C110		Same as C102.	Carrier oscillator Band E trimmer
C111	N16-C-28557-9050 3K1510121	CAPACITOR, FIXED, MICA: JAN type CM15B101K; single section; 100 uuf ±10%; 300 vdcw; characteristic ltr B; 9/32 in. lg x 1/2 in. w x 3/16 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V101 Grid blocking capacitor Band F
C112		Same as C102.	Carrier oscillator Band F trimmer
C113	N16-C-27766-6050 3K1556021	CAPACITOR, FIXED, MICA: JAN type CM15B560K; single section; 56 uuf ±10%; 300 vdcw; characteristic ltr B, 9/32 in. lg x 1/2 in. w x 3/16 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V101 Grid blocking capacitor Band G
C114		Same as C102.	Carrier oscillator Band G trimmer
C115		Same as C105.	V101 Grid blocking capacitor Band H
C116		Same as C102.	Carrier oscillator Band H trimmer
C117		Not used.	
C118		Not used.	
C119	N16-C-15432-5867 3D9002-38	CAPACITOR, FIXED, CERAMIC: JAN type CC21CK020C; single section; 2 uuf ±0.25 uuf; 500 vdcw; characteristic CK; 0.562 in. lg x 0.250 in. dia; insulated case; 2 axial wire leads; per JAN-C20A.	V101 output coupling capacitor
C120	N16-C-18211-7955	CAPACITOR, FIXED, CERAMIC: Standoff type; 500 uuf, ±20%; 500 vdcw; power factor 2.5% at 1 mc. body 5/16 in. lg x 1/4 in. dia one #6-32 thd axial screw term, 1/4 in. lg; one axial wire lead .025 in. dia x 1 1/16 in. lg mfg CER 323. CWV Pt #A-1K3017-52M.	V101 Plate circuit RF bypass capacitor
C121	N16-C046343-9317	CAPACITOR, FIXED, PAPER: 0.25 uf, ±10%; 400 vdcw; characteristic ltr F; hermetically sealed; uninsulated; .562 in. dia x 1 1/16 in. lg; 5/16-24 thd x 9/32 in. lg mtg mfg CAW type P123WGT-400-VDC. CWV Pt #A-1E3154-OR25K.	V101 plate circuit bypass capacitor

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
C122	N16-C-18659-4509 —	CAPACITOR, FIXED, CERAMIC: Feed thru type; 1000 uuf, ±20%; 500 vdcw; power factor 2.5%; 5/8 in. lg x 5/16 in. dia; 2 axial wire leads terminated in a 1/8 in. loop; one #12-28 thd x 11/32 in. lg mtg screw; uninsulated; mfg CAW type HI-K-CFC CWV Pt #A-1K3019-13M.	V101 Plate circuit bypass capacitor (feed-thru)
C123	N16C061909-8566 —	CAPACITOR, VARIABLE: Air dielectric; plate meshing type; single section; 12 uuf to 479 uuf; 3 5/16 in. x 1 27/32 in. x 1 27/32 in.; round metal shaft 1/4 in. dia x 13/32 in. lg; 27 silver plated plates; 180° counterclockwise rotation; mfg CRK type 123, CWV Pt #C-2B1014-1.	Main tuning capacitor
C124		Same as C122.	V101 Heater bypass capacitor
C125	N16-C-18659-7792 —	CAPACITOR, FIXED, CERAMIC: Standoff type; 1000 uuf ±20%; 500 vdcw; power factor 2.5% at 1 kc; special temp coeff; 1 1/64 in. lg x 3/16 dia; one 1/4-28 thd axial screw term 3/8 in. lg; one axial post term; internally grounded; insulated; mfg CER type 326, CWV Pt #A-1K3016-13M.	V101 B+ RF filter
C126		Same as C125.	V101 Heater filter capacitor
C127	N16-C-18659-7793 —	CAPACITOR, FIXED, CERAMIC: Feed-thru type; 1000 uuf, ±20%; 500 vdcw; power factor 2.5% at 1 kc; special temp coeff; insulated; 3/4 in. lg x 5/16 in. dia; 2 axial wire leads terminated in 1/8 in. lg loop; one 1/4-28 x 7/32 in. lg mtg screw; mfg CER type 327, CWV Pt #A-1K3018-13M.	V101 B+ RF filter
C128		Same as C127.	V101 heater RF filter capacitor feed-thru
C129		Same as C121.	V102 Screen bypass
C130	N16-C-42764-8898 3DA10-447	CAPACITOR, FIXED, PAPER: JAN type CN22AX103M; 0.01 uf ±20%; 300 vdcw; characteristic ltr A; molded low loss phenolic case; 5/64 in. lg x 37/64 in. w x 17/64 in. thk; 2 axial wire leads; per JAN-C-91A.	V102 output coupling
C131		Same as C109.	V103 input coupling capacitor
C132	For replacement use SNSN N16-C-19781-4720	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf; tolerance —10% to +250%; 25 vdcw; hermetically sealed in aluminum case; 7/16 in. dia x 1 3/8 in. lg; 2 axial wire leads; mfg CMA type TA26, CWV Pt #A-1N1005-25ROZ.	V103 cathode bypass
C133	For replacement use SNSN N16-C-11008-500	CAPACITOR, FIXED, PAPER: JAN type CP16A3HB203M; 0.02 uf ±20%; 100 vdcw; characteristic ltr H; internally grounded; hermetically sealed metal case; 7/8 in. lg x 23/64 in. dia insulated; 2 axial wire leads; per JAN-C-25.	V103 cathode bypass
C134	N16-C-45805-3601 —	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.1 uf, ±10%; 400 vdcw; characteristic ltr F; hermetically sealed; wax impregnated; internally grounded; uninsulated; .400 in. dia x 3/4 in. lg; 5/16-24 thd x 31/32 in. lg mtg bshg; one axial wire lead; mfg CGF XG-1816-N; CWV Pt #A-1E3153-OR1K.	V103 screen bypass
C135	N16-C-33617-4758 3K3510352	CAPACITOR, FIXED, MICA: JAN type CM35E103J; 10,000 uuf ±5%; 300 vdcw; characteristic ltr E; molded low loss phenolic case; 53/64 in. lg x 53/64 in. w x 3/64 in. thk; 2 axial wire leads; per MIL-C-5A.	V103 output coupling capacitor
C136		Same as C101.	V103 RF output coupling capacitor

C137		Same as C125.	VTVM (V104) output decoupling capacitor
C138		Same as C125.	VTVM (V104)
C139		Same as C133.	VTVM (V104)
C140		Same as C121.	V102 & V103 B+ bypass
C141		Same as C125.	V102 & V103 B+ RF filter capacitor
C142		Same as C125.	Modulation input RF filter capacitor
C143		Same as C125.	V102, V103 & V104 heater RF filter capacitor
C144		Same as C125.	V13 screen voltage RF filter capacitor
C145		Same as C125.	(V104) VTVM output RF filter capacitor
C146		Same as C127.	V102 & V103 B+ RF filter capacitor (feed-thru)
C147		Same as C127.	Modulation input RF filter capacitor (feed-thru)
C148		Same as C127.	V102, V103 & V104 Heater RF filter capacitor (feed-thru)
C149		Same as C127.	V103 Screen voltage RF filter capacitor (feed-thru)
C150		Same as C127.	VTVM (V104) output RF filter capacitor (feed-thru)
C151		Same as C125.	V105 B+ RF filter capacitor
C152		Same as C125.	V105 output RF filter capacitor
C153		Same as C127.	V105 B+ RF filter capacitor (feed-thru)
C154		Same as C127.	V105 Output RF filter capacitor (feed-thru)
C155		Same as C130.	V105 Screen bypass capacitor
C156	N16-C029608-2206 3K2027122	CAPACITOR, FIXED, MICA: JAN type CM20B271J; 270 uuf, ±5%; 500 vdcw; characteristic ltr B; molded low loss phenolic case; 5/64 in. lg x 15/32 in. w x 7/32 in. thk; 2 axial wire leads per MIL-C-5A.	V105 Feed-back capacitor
C157	N16-C-15953-2999 3D9012-38	CAPACITOR, FIXED, CERAMIC: JAN type CC21CH120J; 12 uuf ±5%; 500 vdcw; characteristic CH; 0.562 in. lg x 0.250 in. dia; insulated; 2 axial wire leads; per JAN-C-20A.	V105 Grid capacitor

TABLE 7–2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
C158	N16-C-64041-4565 3D9025V-88	CAPACITOR, VARIABLE, CERAMIC: JAN type CV12A250; rotary type; single section; 6 uuf to 25 uuf; 500 vdcw; temp coeff ltr A; 1.218 in. lg x 15/16 in. w x 45/64 in. thk excl term; 2 solder lug term; two mtg holes tapped 4-40; 3/16 in. deep on .656 in. mtg/c; screwdriver adj; ceramic base; per JAN-C-81.	V105 Frequency Adj. capacitor
C159		Same as C130.	V105 output coupling capacitor
C160	N16-C031080-2522 3K2510243	CAPACITOR, FIXED, MICA: JAN type CM25D102G; 1000 uuf ±2%; 500 vdcw; characteristic ltr D; 1 1/16 in. lg x 15/32 in. w x 7/32 in. thk; molded low loss phenolic case; 2 axial wire leads; per MIL-C-5A.	V106 Bridge capacitor
C161		Same as C160.	V106 Bridge capacitor
C162	N16-C-45805-6260 3DA100-838	CAPACITOR, FIXED, PAPER: JAN type CN43EE104M; 0.1 uf ±20%; 400 vdcw; characteristic ltr E; 1 13/32 in. lg x 49/64 in. w x 3/8 in. thk; molded phenolic case; 2 axial wire leads per MIL-C-91A.	V106 Output coupling capacitor
C163		Same as C162.	V106 coupling capacitor
C164		Same as C130.	V106 coupling capacitor
C165		Same as C130.	V107 Input capacitor
C166	N16-C-46182-8905 3DA200-54	CAPACITOR, FIXED, PAPER: JAN type CN43E204M; 0.2 uf ±20%; 120 vdcw; characteristic ltr E; 1 13/32 in. lg x 49/64 in. w x 13/32 in. thk; molded phenolic case; 2 axial wire leads; per MIL-C-91A.	V107 Output coupling capacitor
C167		Same as C166.	V107 Output coupling capacitor
C168		Same as C122.	Line filter capacitor
C169		Same as C122.	Line filter capacitor
C170	N16-C-18653-9300 —	CAPACITOR, FIXED, CERAMIC: 1000 uuf, ±10%; 500 vdcw; molded insulated body; .250 in. dia x .562 in. lg; 2 axial wire leads; mfg CER type GP2-K-1000; CWV Pt #A-1K3020-13K.	J105 RF filter capacitor
CR101	N16-T051734-0010 2J1N69	CRYSTAL UNIT: JAN type 1N34A; rectifying; germanium; glass-type diode; 60 V max continuous working voltage; 75 V min peak back voltage for zero dynamic resistance; 5 ma min forward current at 1 V; 40 ma max average anode current; 150 ma max recurrent peak anode current; 500 ma max instantaneous surge current, 1 sec; 50 ua at —10 V, 800 ua at —50 V max reverse current; 1 uuf nominal shunt capacity; —50° to 70° amibent temp range; .250 in. dia x .9375 in. lg excl term; 2 axial pigtail leads; per MIL-E-1B.	Audio voltage rectifier
CR102		Same as CR101.	Audio voltage rectifier
E101	N16-S-34557-8351 2Z8304.276	SHIELD, ELECTRON TUBE: JAN type TS102U02; copper, nickel pl; cylindrical; open top; twist lock mtd to socket saddle; 1 3/4 in. lg x .810 in. dia x .930 in. dia of flange piece; w/compression spring; per JAN-S-28A.	Shield for tube V101
E102		Same as E101.	Shield for tube V102

E104	N16-S-34520-3862 2Z8304.57	SHIELD, ELECTRON TUBE: JAN type TS102U01; copper, nickel pl; cylindrical; open top; twist lock mtd to socket saddle; 1⅜ in. lg x .810 in. dia x .930 in. dia of flange piece; w/compression spring; per JAN-S-28A.	Shield for tube V104
E105		Same as E101.	Shield for tube V105
E106	N16-S-34576-6513 2Z8304.275	SHIELD, ELECTRON TUBE: JAN type TS103U02; copper, nickel pl; cylindrical; open top; twist lock mtd to socket saddle; 1 15/16 in. lg x .950 in. dia x 1.065 in. dia of flange piece; w/compression spring; per JAN-S-28A.	Shield for tube V106
E107		Same as E101.	Shield for tube V107
E108	N16-S-34607-6039 2Z8304-277	SHIELD, ELECTRON TUBE: JAN type TS102U03; copper, nickel pl; cylindrical; open top; twist lock mtd to socket saddle; 2¼ in. lg x .810 in. dia x .930 in. dia of flange piece; w/compression spring; per JAN-S-28A.	Shield for tube V108
E109	N17-C-99999-892 2Z3350-123	CAP, ELECTRICAL, CONNECTOR: Army-Navy type CW-123A/U; for BNC connectors; brass, silver pl; round; approx ⅝ in. lg x 9/16 in. dia; twist lock mtg; approx 2 in. lg chain for securing to panel.	Protective cap for J101
E110		Same as E109.	Protective cap for J102
E111		Same as E109.	Protective cap for J105
E112	N17-C-945001-850 —	COVER, JACK: Self closing; opens to full 90° for plugs to ⅝ in. dia, 1 1/32 in. lg x 13/16 in. dia x 5/16 in. h excl arm; cover with neoprene rubber pad; mfg Pt #CAHW A-23559; CWV Pt #A-16X1000-1.	Protects carrier-meter-zero control
E113	For replacement use SNSN N17-K-700061-468	KNOB, INSTRUMENT: Bar, phenolic, black, 1⅛ in. lg x 11/16 in. h x ⅜ in. w; bar brass insert 17/32 in. lg, drilled 7/16 in. dp for .256/.254 dia round shaft held by 2 headless set screws #8-32; mfg Pt #Whitso Inc. #K-105; CWV Pt #B-74E1004-1.	Carrier range switch (S101) knob
E114		Same as E113.	Carrier control (R173) knob
E115		Same as E113.	Audio output control (R165) knob
E116		Same as E113.	Microvolts control (R119) knob
E117		Same as E113.	Mod, xtal & meter selector (S102) knob
E118		Same as E113.	RF Multiplier (step attenuator) knob
E119	N16-K-700094-251 —	KNOB, CONTROL: Round, bar and pointer, positive gripping surface, set screw type; black phenolic material, 2½ in. lg overall, 1 1/32 in. w overall, ¾ in. thk overall; molded skirt 1 3/16 in. w, ⅜ in. brass insert, removable; mfg Pt # CAG type KNB-2; CWV Pt #A-74F1002-1.	Frequency band switch knob
E120	For replacement use SNSN N17-P-69136-2412	POST, BINDING: Brass cap, nickel pl; brass base, nickel pl; 1 3/64 in. max h of post above mtg surface; mtg stud #10-32 x 25/32 in. lg; wire hold .098 dia; captive nut type cap with hole for standard ¾ in. banana plug; CWV Pt #A-16F1001-1.	Front panel ground post
E121	GM17-L-6543-100 2Z5932	LAMP, INCANDESCENT: 3V, 190 ma; bulb T-1¼ clear, 35/64 in. lg overall; special screw base; C-2R tungsten filament; burn any position; CWV Pt #A-42A1005-1; mfg Herzog Miniature Lamp Work type LM-32.	Illuminates frequency scale
E122		Same as E121.	Illuminates frequency scale

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
E125	# —	TERMINAL, STANDOFF: Brass terminal; body insulated per MIL-P-14; 5/8 in. lg o/a; 1/4 in. lg term; .233 in. dia body; #4-40 x 5/32 in. dp mtg insert; mfg Garde Mfg Co.; CWV Pt #A-49F1022-7.	Terminal for R174, R175
E126		Same as E125.	Terminal for R174, R175
E127	# —	INSULATOR:Melamine glass fibre, type GMG, spec #17P25, 1 1/4 in. lg x 1/4 in. w x 43/32 in. thk; two .1285 drilled holes, centered on width, located 17/32 in. and 1 1/32 in. from end. CWV Pt #A-60D1050-1.	Insulator for instrument lamp contactor
E128		Same as E127.	Insulator for instrument lamp contactor
E129	N17-C-780616-281 —	CABLE LAMP: 1/2 in. w; .204 in. dia mtg hole; for .125 in. max dia cable; mfg Commercial Plastics Co., Chicago, Ill. CWV Pt #A-51A1018-1.	Clamp for dial interconnecting wires
E130	# —	SUPPORT, CONTACTOR: Melamine glass fibre, type GMG; 1 7/8 in. lg x 5/16 in. w x 1/16 in. thk o/a; two .096 in. dia holes located 3/16 in. and 7/16 in. from end; two .1285 in. dia holes located 1 5/32 in. and 1 21/32 in. from end. CWV Pt #A-60D1051-1.	Support for K101
E131	# —	SPADE BOLT & RIVET ASSEMBLY: one spade bolt, brass; 1 1/64 in. lg o/a; 15/32 in. lg x .042 in. thk head with one .094 in. dia hole for coin silver rivet .218 in. w head x .031 in. thk; #6-32, NC-2 x 35/64 in. lg thd. CWV Pt #B-90B1392-501.	Contact terminals for turret oscillator
E132 thru E162		Same as E131.	Contact terminals for turret oscillator
E163	# —	TERMINAL, STANDOFF: Brass terminal and stud; insulated body per MIL-P-14; 1 3/16 in. lg o/a; .233 in. dia x 3/8 in. lg insulated body; .093 in. dia x 7/32 in. lg terminal; #6-32 x 7/32 in. lg mtg stud; mfg Garde Mfg. Co., Providence, R.I.; CWV Pt #A-49F1017-32.	Support for R145 and C155
E164		Same as E163.	Support for R145 and C155
E165		Same as E163.	P/O Variable Capacitor assembly
E166		Same as E163.	P/O Variable Capacitor assembly
E171	# —	DISC, CONTACT: Melamine glass fibre, type GMG, spec 17P25; 1 63/64 in. dia x 1/4 in. thk; seven .120 in. dia mtg holes; four .120 in. dia holes with 1/4 in. dia x 5/32 in. deep counterbore; four .156 in. dia mtg holes. CWV Pt #C-60D1046-1.	Mounts Z109
E172	# —	TERMINAL TURRET: Brass, 21/64 in. lg o/a; .090 in. dia x 7/64 in. lg shank; mfg CAM Q #X-1558B; CWV Pt #A-49F1013-2.	Turret terminals for TB101 and buffer board assy
E173	# —	TERMINAL, TURRET: Brass, 23/64 in. lg o/a; .090 in. dia x 9/64 in. lg shank; mfg CAM Q #1558C; CWV Pt #A-49F1013-3.	Turret terminals for TB104
E174	N16-G-900104-659 6Z4872	GROMMET, ELASTIC: type AN931-A3-5.	Grommet for front panel

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

E175	# —	GASKET: Neoprene; U shape; 21/32 n. h o/a; .060 in. thk at base, tapers to 3/64 in. at top; .055 in. space between sides at bottom tapers to .033 in. at top; mfg Atlantic India Rubber Co. #X397, CWV Pt #A-88A1003-1.	Gasket for case
E176	# —	GASKET: Neoprene; U shape; 15/64 in. h o/a; 5/32 in. w o/a; tapers to 1/8 in. w; 5/32 in. lg slot, 1/16 in. w tapers to 1/32 in. w; mfg Atlantic India Rubber #X-650; CWV Pt #A-88A1008-1.	Gasket for dial cover
E177	# —	INSULATOR: Melamine glass fibre, type GMG, spec 17P25; 3 5/16 in. lg x 2 1/8 in. w x 3/16 in. thk; four .180 in. dia holes on 2.750 in. x 1.625 in. mtg/C; four .180 in. dia holes on 1.562 in. x 1.0 in. mtg/C; one .166 in. dia drilled hole; CWV Pt #A-60D1039-1.	Mounts C123 to main casting
E178	# —	TURRET, COIL: Melamine glass fibre; type GMG; 6 1/8 in. OD x 3/8 in. thk; center hole .625 in. dia; four .1695 in. dia mtg holes, 90° apart, .750 in. from center of turret; notch 3/8 in. w on dia, tapers to 90°, equally spaced 8 times; six .140 in. dia holes and two .110 in dia holes located between adjacent notches and repeated eight times around turret; CWV Pt #D-82B1031-1.	Turret for mtg oscillator coils
E179		Same as E130.	Support for K102
E180	Shop Manufacture —	GASKET: Synthetic rubber; .330 in. OD x .205 in. ID x .125 in. w; mfg CARO #1211; CWV Pt #A-88A1009-1.	P/O AT101 input cable assy
E189	N17-T028244-2475 —	TERMINAL, FEED-THRU, INSULATED: Turret type conductor; Grade L-5 ceramic insulation; brass term., silver plated; 29/32 in. lg o/a; 3/16 in. lg turret each end; hex shoulder 3/8 AF; 1/4-28 thd mtg bushing; mfg CAMQ #X1990, CWV Pt #A-49F1021-1.	Feed-thru between RF oscillator and buffer amplifier
F101	GM17-F-16302-80 3Z2601.16	FUSE, CARTRIDGE: 1 amp, 250 volts max; open in one hour at 135% load; rated continuous at 110% load; one time; glass body; ferrule term.; 1 1/4 in. lg x 1/4 in. dia; o/a; slow blowing; mfg CLF type 3AG, "slo-blo"; CWV Pt #A-43A1001-1.	AC power input line fuse
F102		Same as F101.	AC power input line fuse
F103		Same as F101.	Spare fuse
F104		Same as F101.	Spare fuse
H101	# —	BUMPER, MACHINE SCREW: Black neoprene; 1/2 in. dia x 1/4 in. thk bumper; #6-32 x 1/4 in. lg attached screw; mfg Minor Rubber Co.; CWV Pt #A-38C1017-1.	Bumper for case
H102	# —	BUMPER, MACHINE SCREW: Black neoprene; 3/4 in. dia x 3/8 in. thk bumper; #8-32 x 1/4 in. lg attached screw; mfg Minor Rubber Co.; CWV Pt #A-38C1017-3.	Bumper for case
H103	# —	SCREW, CAP: Slotted head 1/2 in. dia; 5/16 in. lg o/a; 3/8-24 NF-2 thread; 3/16 in. lg; CWV Pt #A-82A1293-1.	Plug for oscillator coil adjusting holes in casting
H104	# —	POST, MOUNTING: Aluminum; 5/16 in. dia x .485 in. lg o/a; center hole .136 in. dia x 5/16 in. dp drilled tapped #8-32 NC-2, 1/4 in. dp rivet type mtg .1875 in. dia x .078 w; CWV Pt #A-82A1275-1.	Post for mounting adapter plate to cover
H105	# —	NUT, SPECIAL: Brass, hex shape, 3/4 in. AF x 3/16 in. thk; center hole tapped 5/8-24 Cl. 2; CWV Pt #A-82A1285-1.	P/O Turret drive assy
H106	# —	SCREW, CAPTIVE: Stainless steel; .671 in. lg o/a; slotted head 3/8 in. dia x 9/64 in. thk; #10-32 NF-2 thread 7/32 in. lg; .130 in. dia unthreaded part; CWV Pt #A-82A1217-1.	Secures Signal Generator SG-111/URM-25E to case
H107	# —	FERRULE: Brass; 1/4 in. thk o/a; 9/16 in. dia for approx. .115 in., tapers to 13/32 in. dia; .320 in. dia bored hole, .188 in. dp; 7/32 in. dia drilled hole thru; mfg CAM Q #X1988; CWV Pt #A-82A1248-1.	Ferrule for front panel handles

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
H108	# —	POST, CABLE RETAINER: Aluminum; 5/64 in. lg o/a; shoulders at top and bottom 5/16 in. dia x 3/32 in. thk; 3/16 in. dia body in between 5/8 in. lg mtg section to spin .125 in. dia x .109 in. deep; CWV Pt #A-82A1249-1.	Post for mtg RF cables
H109	# —	STUD, CHASSIS MOUNTING: Stainless steel; .297 in. lg o/a; shoulder .375 in. dia x .141 in. thk; center hole threaded #8-32, NC-2, 3/16 in. lg; CWV Pt #A-82A1238-1.	Mounts modulator assy to front panel
H110	# —	SCREW, ADJUSTING: Stainless steel, headless; 1/2 in. lg; #12-28, NF-2 thd entire length; 3/64 in. w x 1/16 in. dp slot; end drilled, std center #a1, 1/8 in. dia countersink; CWV Pt #A-82A1234-1.	Adjusts miter gears for turret
H111	# —	BUSHING, ADJUSTING: Bronze; 13/16 in. lg o/a; hex head 3/16 in. thk, 3/4 in. AF 17/32 in. dia counterbore, 1/4 in. dp; 5/8 in. x 24 NEF-2 thd, 1/4 in. lg outside; #12-28 NF-2 tap inside; CWV Pt #A-82A1235-1.	Adjusting bushing for turret shaft and adjusting screw
I101	GM17-L-06806-0130 2Z5888-5	LAMP, GLOW: Neon gas; miniature bayonet single contact base, MBCA ref dwg group 7, T-3 1/4 clear bulb; external resistance 200,000 ohms for 105 to 125 v operation; burn any position; gov type #VG-16; General Elecetric Pt #NE-51.	Power on-off indicator
J101	N17-C073108-2878 2Z7390	CONNECTOR, RECEPTACLE, ELECTRICAL: JAN type UG-290A/U; one contact; one connector mating end; female coaxial connector rated 500 v peak, 52 ohms impedance; plastic; straight shape; o/a dim. excluding protruding term., 3/4 in. lg x 11/16 in. w x 11/16 in. h; polarized; bayonet latch type; 4 #3-56 NF-2B thd mtg holes on 1/2 in. x 1/2 in. centers per MS35174.	RF OUTPUT X-200K jack
J102	# —	COLLAR & CONNECTOR ASSY: 1 round coaxial female contact; consists of one UG-290/U connector; and one collar soldered to connector contact; CWV Pt #B-90B1429-501.	Step attenuator AT101 output connector
J103		Same as J101.	Connector for step attenuator AT101
J105		Same as J101.	EXT MOD IN-AUDIO OUT-XTAL CAL OUT Receptacle
K101	# —	CONTACTOR: Phosphor bronze, spring temper; irregular shape; 5/16 in. w; 1 5/8 in. lg o/a; two .096 in. dia mtg holes; one .0635 dia hole; one .196 dia hole; 45° bend at one end; 3/32 in. bend at other end; CWV Pt #A-79D1015-1.	Contact for frequency dial lamp
K102		Same as K101.	Contact for frequency dial lamp
K103	# —	SPRING, CONTACT: Beryllium copper; .0063 thk heat treated; irregular shape; .149 in. w x 11/16 in. lg o/a; center of spring arc shape, 7/32 R. with each end bent in same plane; one .067 hole, centered .078 from end and 5/64 in. from edge; CWV Pt #A-79D1006-1.	P/O contact disc Z109
K104		Same as K103.	P/O Contact disc Z110
K105		Same as K103.	P/O Contact disc Z111
K106		Same as K103.	P/O Contact disc Z112

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

K107	# —	SPRING, GROUNDING: Beryllium copper, heat treat; irregular shape; .006 in. thk; approx 1 27/64 in. lg o/a; 1 in. w max; 5/16 in w, min; two .128 in. dia holes on .312 in mtg/C; one 5/8 in. lg x 1/16 in. w slot; CWV Pt #B-79D1013-1.	Grounding spring bar turret
L101	N16-C076509-4887 —	COIL, OSCILLATOR: one winding; 4 pie universal wound; 5310 turns at #40 AWG, S.S.E. wire; inductance 530-650 mh with 1/4 in. change in position of tuning slug; dc resistance 1065Ω ±5%; tapped at point of 61 mh inductance from start; CWV Pt #B-12N1006-501.	Band A oscillator coil
L102	N17-T081864-7763 —	COIL, OSCILLATOR: one winding; 3 pie universal wound; 1950 turns of #40 AWG single nylon enameled wire, tapped at 850 turns; inductance 47 mh at 79 kc; dc resistance 430Ω ±10%; CWV Pt #B-12N1004-501.	Band B oscillator coil
L103	N16-C076508-4327 —	COIL, OSCILLATOR: one winding; 2 pie universal wound; 600 turns total of #36 AWG double nylon enameled wire tapped at 375 turns; inductance 4.7 mh ±5% at 250 kc; dc resistance 55Ω ±10%; CWV Pt #B-12N1009-501.	Band C oscillator coil
L104	N16-C072880-7656 —	COIL, OSCILLATOR: one winding; 1 pie universal wound; 160 turns of #36 AWG double nylon enameled wire; tapped at 85 turns; inductance 500 uh ±5% at 790 kc; dc resistance 12.7Ω ±10%; CWV Pt #B-12N1007-501.	Band D oscillator coil
L105	N16-C073466-7280 —	COIL, OSCILLATOR: one winding; 1 pie universal wound; 48 turns total, #36 AWG double nylon enameled wire; tapped at 37 turns; inductance 52 uh ±5% at 2.5 mc; dc resistance 3.4Ω ±10%; CWV Pt #B-12N1008-501.	Band E oscillator coil
L106	N17-T073262-8948 —	COIL, OSCILLATOR: one winding; single layer wound; 20 turns total; #30 AWG enameled copper wire tapped at 10 turns; inductance 4.1 uh ±5% at 7.9 mc; dc resistance 0.3Ω ±10%; CWV Pt #B-12N1005-501.	Band F oscillator coil
L107	N17-T071815-4944 —	COIL, OSCILLATOR: one winding; single layer wound; 7 turns total, .005 thk x 1/16 in. w silver strip; tapped at 3 turns; inductance 0.375 uh ±5% at 25 mc; CWV Pt #B-12N1010-501.	Band G oscillator coil
L108	N16-C072985-2545 —	COIL, OSCILLATOR: one winding; single layer wound; 4 turns total, .005 thk x 1/16 in. w silver strip; tapped at 2 turns; inductance .157 uh ±5% at 25 mc; CWV Pt #B-12N1011-501.	Band H oscillator coil
L109	N16-C074605-5348 —	CHOKE, RADIO FREQUENCY: one winding; 3 pie universal wound; 429 turns #36 AWG single nylon enameled wire wound 151 turns/pie; inductance 2.5 mh ±5% at 250 kc; dc resistance 18.3Ω ±10%; CWV Pt #B-12B1021-501.	V101 B+ RF filter choke
L110	N16-C072859-4375 —	CHOKE, RADIO FREQUENCY: one winding; single layer wound; 14 1/2 turns #28 AWG enameled copper wire, closewound; inductance 3.0 uh ±10% at 7.9 mc; CWV Pt #B-12B1018-501.	V101 heater RF filter coil
L111	N16-C072609-7097 —	CHOKE, RADIO FREQUENCY: one winding; single layer wound; 44 turns, #36 AWG enameled nylon wire, closewound; inductance 1.9 uh ±5% at 7.9 mc; CWV Pt #B-12A1030-501.	V102 coupling network coil
L112		Same as L111.	V102 coupling network coil
L113	N16-C076564-9303 —	CHOKE, RADIO FREQUENCY: one winding; single layer wound; 17 turns, #36 AWG enameled nylon wire closewound; inductance 0.68 uh ±5% at 25 mc; CWV Pt #B-12A1030-502.	V102 coupling network coil
L114	N16-C072503-8547 —	CHOKE, RADIO FREQUENCY: one winding; single layer wound; inductance 1.5 uh ±5% at 7.9 mc; 34 turns #36 AWG enameled nylon wire, closewound; CWV Pt #B-12A1030-503.	V102 coupling network coil
L115	N16-C073173-8446 —	CHOKE, RADIO FREQUENCY: one winding; single layer wound; 27 turns, #36 AWG enameled nylon wire, closewound; inductance 1.15 uh ±5% at 7.9 mc; CWV Pt #B-12A1030-504.	V103 coupling network coil

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
L116		Same as L109.	V103 plate choke
L117	N16-C076786-6468 —	CHOKE, RADIO FREQUENCY: one winding; 5 pie universal wound; 1055 turns #40 AWG single nylon wire; wound 207 turns/section; inductance 11 mh ±5% at 79 kc; dc resistance 108.8Ω ±10%; CWV Pt #B-12B1020-501.	V103 plate choke
L118		Sameas L117.	V103 plate choke
L119	N16-C073720-1602 —	CHOKE, RADIO FREQUENCY: one winding; 2 pie universal wound; 180 turns, #38 AWG single nylon enameled wire; wound 90 turns/section; inductance 100 uh ±10% at 790 kc; dc resistance 8.9Ω ±10%; CWV Pt #B-12A1029-501.	V102 and V103 B+ RF filter coil
L120		Same as L110.	V102, V103 & V104 heater RF filter coil
L121		Same as L109.	V105 cathode RF choke
L122	N16-C076545-4103 —	CHOKE, RADIO FREQUENCY: one winding; single layer wound; 15 turns, #32 AWG enameled copper wire, wound 90 turns/inch; inductance 1.5 uh ±5% at 7.9 mc; dc resistance 0.2Ω ±10%; CWV Pt #B-12A1031-501.	Line filter choke
L123		Same as L122.	Line filter choke
L124		Same as L119.	J104 RF filter choke
M101	N17-M027189-2174 —	METER: JAN type MR26W100DCUAR per MIL-M-10304; multiscale; DC; range 0 to 100 microamps; CWV Pt #B-69D1004-1.	RF output and modulation meter
N101	# —	DIAL, VERNIER: for interpolating frequency tuning dial; arc shape; nickel silver (18%); 90° long on 1 3/16 in. outside radius and .875 in. inside radius; .081 in. thk; ten scale divisions; two .125 in. dia mtg holes spaced 5/16 in. from center on 1 1/32 in. radius; CWV Pt #B-62C1004-1.	Vernier for tuning dial
N102	# —	KNOB & DIAL ASSEMBLY: Frequency tuning; etched aluminum dial plate and phenolic knob, material type CFG per MIL-P-14; round 1¾ in. dia dial plate, .040 in. thk; 1⅛ in. dia knob; brass insert for ¼ in. dia shaft; two #8-32 set screws; dial plate marked in 100 equally spaced divisions; CWV Pt #B-90B1446-501.	Main tuning
N103	# —	WINDOW, FREQUENCY SCALE: .040 in. thk lucite, per MIL-P-5425A; 2¼ in. lg x 1 11/16 in. w; four .136 in. dia holes on 1.875 in. x 1.312 in. mtg/C; CWV Pt A-62F1009-1.	Window for frequency scale
N104	# —	INDICATOR, DIAL: Frequency scale; .062 in. thk; lucite, clear per MIL-P-5425A; 6¼ in. lg x 2½ in. w; 1⅛ in. dia hole in center; four .136 in. dia holes on 5⅞ in. x 2⅛ in. mtg/C; black hairline 45° groove, .007 in. deep on center of long axis on both sides; CWV Pt #B-62F1010-1.	Frequency scale indicator
N105		Same as N103.	Window for frequency scale
O101	# —	GEAR, BLANK: round; .0625 in. thk brass; 280 teeth; 48 DP on 5.833 PD; 20° pressure angle; center hole .5005/.5000 reamed; .067 in. dia hole 1 13/64 in. from center hole; .1285 in. dia hole 1⅜ in. from center hole and 40° from .067 in. dia hole; CWV Pt #B-85A1009-1.	Frequency scale dial gear

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

O102	# —	GEAR, BLANK: round; .0625 in. thk brass; 280 teeth; 48 DP on 5.8333 PD; 20° pressure angle; center hole .7505/.7500 reamed; .067 in. dia hole 1 15/64 in. from center hole; 7/8 in. dia hole 1 3/8 in. from center hole and 55° from .067 in. dia hole; CWV Pt #B-85A1009-2.	Anti-backlash gear for frequency scale
O103	# —	HUB, SPUR GEAR: Brass, irregular shape; .7495/.7490 in. dia x .760 in. lg o/a; .625 in. dia from 1/8 in.; .7495/.7490 in. dia for approx .298 in.; under cut .058 in. w x .582 in. dia; .7495/.7490 in. dia for .175 in.; swaging section .5000/.4995 in. dia x .104 in. thk with .2505/.2500 in. reamed thru hole and .438 in. dia x 7/64 in. dp, C'bored hole; CWV Pt #A-82A1289-1.	P/O Spur gear assy Z116
O104	# —	SPRING, GEAR: Music wire per MIL-W-6101; .063 in. dia; dull nickel plate; 2 1/2 in. dia ring o/a; spring stops located 1 1/8 in. apart; stops 1/16 in. lg bent 90° from axis; CWV Pt #A-79B1009-1.	P/O Spur gear assy Z116
O105	# —	SHUTTER, DIAL: Shutter for masking and uncovering ranges on frequency scale; No. 18 ga. Al; black anodize on one side, white gloss baked enamel on other; 5 5/16 in. dia; with .5625 in. hole in center and (3) .101 size mtg holes, 120° apart on .406 radius; four 1/4 in. w slots, 45° apart, 15/16 in. lg on 1 21/32 in. radius, 1 1/16 in. lg on 1 29/32 in. radius, 1 3/16 in. lg on 2 5/32 in. radius, 1 1/4 in. lg on 2 13/32 in. radius; CWV Pt #B-62B1019-1.	Frequency scale shutter
O106	# —	HUB, SHUTTER: Brass; 1 in. dia x .042 in. thk shoulder; .560 in. dia x .270 in. thk hub with .251/.2505 in. dia reamed center hole; three .101 in. dia mtg holes in shoulder, located on .812 in. dia, 120° apart; 2 #6-32, NC-2, tapped holes, 120° apart in hub; CWV Pt #A-82A1224-1.	Hub to mount dial shutter
O107	# —	SUPPORT, ROLLER: Brass; U shape; .064 in. thk; 3/4 in. x 11/16 in. base; 9/16 in. sides .187 in. w x 3/16 in. dp slot in sides; two .1285 in. dia mtg holes in base spaced .375 in. apart; CWV Pt #A-82A1219-1.	Support for turret detent Z106
O109	# —	BLOCK, CONTACT MOUNTING: Brass; 23/32 in. lg x 3/16 in. w x .156 in. thk; flat on width 3/16 in. lg x .015 in. dp, with one .067 in. dia hole 5/64 in. from end; groove 7/32 in. lg x .156 in. w x .031 in. dp; two #4-40 NC-2 tapped mtg holes, each 9/64 in. from center; CWV Pt #A-82A1245-1.	Contact disc mounting block
O110		Same as O109.	Contact disc mounting block
O111		Same as O109.	Contact disc mounting block
O112		Same as O109.	Contact disc mounting block
O113	# —	GEAR, WORM: Bronze; 32 pitch, 4 thd; 80 teeth; 2.500 PD; face .125; .6567/.6562 in. dia reamed center hole; one .070 in. dia drilled hole 23/32 in. from center; CWV Pt #B-85D1002-1.	Free gear for variable capacitor
O114	# —	GEAR, WORM: Bronze; 32 pitch, 4 thd; 80 teeth; 2.500 PD; face .125; hub .6555/.6550 in. dia x .437 in. lg o/a; .3135/.3130 in. dia reamed hole; two #6-32 NC-2 tapped holes in hub, 120° apart; one .070 in. drilled hole, 23/32 in. from center; CWV Pt #B-85D1001-1.	Fixed gear for variable capacitor drive
O115	# —	SPRING, TENSION: Music wire per MIL-W-6101; .063 in. dia; dull nickel plate 1 3/4 in. dia ring o/a; spring stops located 1 in. apart; stops 3/16 in. lg bent 90° from axis; CWV Pt. #A-79B1008-1.	P/O Worm gear assy Z114
O116	# —	BEARING, BRONZE: .375 in. lg o/a; shoulder .481 in. dia x 3/64 in. thk; hub .377 in. dia x 21/64 in. lg; .252 in. dia drilled center hole; CWV Pt #A-86B1005-1.	P/O Variable attenuator assy
O117		Same as O116.	P/O Variable attenuator assy
O118		Same as O116.	P/O RF housing

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
O119		Same as O116.	P/O RF housing
O120		Same as O116.	P/O RF housing
O121	# —	BEARING: Bronze; .625 in. lg o/a; shoulder .481 in. dia x 3/64 in. thk; hub .377 in. dia x 37/64 in. lg; .252 in. dia drilled center hole; CWV Pt #A-86B1005-2.	P/O RF housing
O122		Same as O121.	P/O RF housing
O123	# —	BEARING: Bronze; .375 in. lg o/a; shoulder .6875 in. dia x .094 in. thk; hub .502 in. dia x .281 in. lg; .314 in. dia drilled center hole; CWV Pt #A-86B1006-1.	P/O RF housing
O124		Same as O123.	P/O RF housing
O125	# —	COLLAR, CONNECTOR: Brass; 1/4 in. dia x .250 in. lg; .096 in. dia center hole; CWV Pt #A-82A1270-1.	Collar for BNC connector
O126	# —	BUSHING, JACK COVER: Aluminum; .341 in. lg o/a; shoulder 1/2 in. dia x .141 in. thk, .376/.372 in. dia body; .312 in. dia center hole; CWV Pt #A-82A1273-1.	Bushing for mounting jack cover to front panel
O127	# —	SHAFT, DIAL DRIVE: Stainless steel; 4 5/16 in. lg o/a; four different dial sizes; .250/.248 in. dia for .750 in.; .333 in. dia for 7/8 in. includes 1/2 in. lg gear cut 14 teeth — 48 pitch — 20° pressure angle — PD .2917; .2496/.2491 in. dia for 1.750 in.; .1866/.1860 in. dia for 15/16 in.; CWV Pt #B-82A1250-1.	Drive shaft for spur gear and variable capacitor
O128	# —	SHAFT, TURRET: Stainless steel; 2.906 in. lg; .250 in. dia; std A center drill one end; 13/32 in. lg flat other end; CWV Pt #A-82A1227-1.	Turret shaft
O129	# —	SHAFT, BAND SWITCH: Stainless steel; 4 3/4 in. lg x 1/4 in. dia; 13/32 in. lg flat one end; CWV Pt #A-82A1236-1.	Band switch shaft
O130	# —	SHAFT, WORM GEAR: Stainless steel; 2.375 in. lg o/a; .547 in. lg; .248 in. dia; 1 53/64 in. lg, .3124 in. dia under cut .028 in. w x .250 in. dia on one end; CWV Pt #A-82A1243-1.	Worm gear shaft for variable capacitor
O131		Same as O123.	P/O RF housing
O132	# —	GEAR, WORM: Steel, rh; 32 pitch, 4 thds; lead angle 15°57′; 25° pressure angle; .438 in. PD; 1/16 in. lg face; 3/16 in. lg hub projection; .360 in. dia hub with .0785 in. dia hole for 5/0 grooved pin; .1875 in. dia drilled center hole; mfg CBH #QTH; CWV Pt #A-85D1000-1.	Worm for variable capacitor drive
O133	# —	BALL: Stainless steel; .125 in. spherical dia; CWV Pt #A-86A1000-2.	P/O Turret drive
O134	# —	GEAR, MITER: Brass, straight type; 24 teeth, 5/32 in. w face; .750 PD; 45° pitch angle; hub 1/2 in. OD x 25/64 in. lg through; .250 in. dia reamed hole; two #6-32 NC-2 tapped holes in hub, 120° apart; CWV Pt #A-85B1001-1.	P/O Turret drive
O135	# —	COLLAR, STOP: Stainless steel; 5/16 in. dia x .266 w o/a; protruding shoulder .468 in. dia x .047 in. w; two #6-32 NC-2 tapped holes 120° apart; center hole .3125 reamed; CWV Pt #A-82A1319-1.	P/O Variable capacitor drive

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

O136	# —	SPRING, DETENT: Beryllium copper, heat treated; irregular shape; 1 1/16 in. w x approx 3 1/16 in. lg o/a; 1 in. of length 1 1/16 in. w and tapers to 3/4 in. w; tapered end bent total of 45° from vertical axis; four .120 in. dia holes on .812 in. x .500 in. mtg/C; two .128 in. dia holes on center axis; CWV Pt #B-79B1007-1.	P/O Turret detent Z106
O137	N17-C098378-7237 —	COUPLING, INSULATED: Body, brass, nickel plate; insulation per MIL-T-945; 17/32 in. w x 1 3/16 in. dia; CWV Pt #B-15A1010-2, Mfg CJA Pt #39016.	Connects capacitor C123 to drive shaft
O143	# —	GEAR, SPUR: round; 1/8 in. thk body; 72 teeth; 48 DP on 1.500 PD; 14 1/2° pressure angle; center hole .2510/.2504 reamed; 1/2 in. dia x 1/4 in. thk hub with two #6-32, NC-2 tapped holes 120° apart; CWV Pt #A-85A1010-1.	Pinion gear for variable attenuator
O144	# —	GEAR, SPUR: round; 1/8 in. thk body; 84 teeth; 48 DP on 1.750 PD; 14 1/2° pressure angle; center hole .2510/.2504 reamed; 1/2 in. dia x 1/4 in. thk hub with two #6-32, NC-2 tapped holes, 120° apart; CWV Pt #A-85A1011-1.	Drive gear for variable attenuator
O152	Shop Manufacture —	HANDLE: Aluminum, anodized; 6 in. lg, 1 11/16 in. w, 5/16 in. dia; tapped hole #8-32, NC-2 1/2 in. dp at each end; CWV Pt #B-76D1006-1.	Carrying handles
P101	N17-C-71125-1404 2Z3063-9	CONNECTOR, PLUG: 2 rectangular female polarized contacts; straight type; 21/32 in. dia x 15/16 lg excl cable clamps; 730 v rms; 10 amp cylindrical crystal finish metal body; molded black bakelite insert; cable opening 7/16 in. dia max; incl adj grip cable clamp; locking latches on two sides; mfg CJC type S-302-CCTL; CWV Pt #A-18F1007-2.	P/O Interconnecting AC power cable
P102	N17-C-71515-8118 2Z7228-17	CONNECTOR, PLUG: 6 flat polarized blades; straight type; 1 in. lg x 11/16 in. w x 1 1/16 in. dp, excl contacts and cable clamp; 730 v rms; 10 amps rectangular crystal finish metal body; molded black bakelite insert; cable opening 7/16 in. dia max; incl adj grip cable clamp; locking latches on two sides; mfg CJC type P-306-CCTL; CWV Pt #B-17B1006-6.	P/O Power supply output power cable (W103)
P103	N17-C-71408-5333 2Z7390-88	CONNECTOR, PLUG: JAN type UG-88/U; one round coaxial male contact; straight type; 31/32 in. lg x 27/64 in. dia o/a; 52 ohms impedance; cylindrical brass, silver pl; locking type body; molded polystyrene insert; cable opening approx 7/32 in. dia per MIL-C-3608.	P/O Step attenuator AT101
P104		Same as P103.	P/O RF output cable (W104)
P105		Same as P103.	P/O RF output cable (W104)
P106		Same as P103.	P/O RF output cable (W105)
P107		Same as P103.	P/O RF output cable (W105)
P108		Same as P103.	P/O RF output cable (W106)
P109		Same as P103.	P/O RF output cable (W106)
P110	N17-C071464-8682 2Z3023-169	CONNECTOR, PLUG, ELECTRICAL: JAN type UP-121/M; (3) contacts; (1) connector mating end; contact data, Section A, ref dwg group 206 part one A B C D E F G 2 ML 1 PP 15 NR 105-125 1 ML 6 N/A N/A N/A N/A part two H J K L XX N/A N/A N/A XX N/A CS WGD arc resistant plastic; straight shape; o/a dim. excluding protruding contacts and terminals, cable clamps and cord protectors, 1 17/32 in. lg x 23/32 in. w x 3/4 in. h; polarized; non-locking type; accommodates 15/32 in. dia max cable; per MIL-C-3767.	Power input plug

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
R101	N16-R-50975-811 3RC20BF105K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF105K; 1 megohm ±10%; ½W; 350 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band A, V101 grid leak resistor
R102	N16-R-50480-811 3RC20BF473K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF473K; 47K ±10%; ½W; 153 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band A, V101 cathode resistor
R103	N16-R-50822-811 3RC20BF474K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF474K; 470K ±10%; ½W; 350 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band B, V101 grid leak resistor
R104	N16-R-50372-811 3RC20BF223K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF223K; 22K ±10%; ½W; 105 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band B, V101 cathode resistor
R105	N16-R-50786-811 3RC20BF394K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF394K; 390K ±10%; ½W; 350 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band C, V101 grid leak resistor
R106	N16-R-50354-811 3RC20BF183K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF183K; 18K ±10%; ½W; 95 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band C, V101 cathode resistor
R107	N16-R-50651-811 3RC20BF124K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF124K; 120K ±10%; ½W; 300 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band D, V101 grid leak resistor
R108	N16-R-50201-811 3RC20BF682K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF682K; 6800 ohms ±10%; ½W; 68 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band D, V101 cathode resistor
R109		Same as R102.	Band E, V101 grid leak resistor
R110	N16-R-49922-811 3RC20BF102K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF102K; 1000 ohms ±10%; ½W; 2.2 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band E, V101 cathode resistor
R111		Same as R104.	Band F, V101 grid leak resistor
R112	N16-R-50282-811 3RC20BF103K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF103K; 10K ±10%; ½W; 71 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia. x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band G, V101 grid leak resistor
R113	N16-R-50129-811 3RC20BF472K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF472K; 4700 ohms ±10%; ½W; 48 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	Band H, V101 grid leak resistor
R114	N16-R-50633-811 3RC20BF104K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF104K; 100K ±10%; ½W; 274 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V102 Grid resistor

R115	N16-R-49633-431 3RC20BF161J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF161J; 160 ohms ±5%; ½W; 8.9 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V102 cathode resistor
R116	N16-R-50012-811 3RC20BF222K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF222K; 2200 ohms ±10%; ½W; 33 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	L111 Damping resistor
R117	N16-R-50417-811 3RC20BF333K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF333K; 33K ±10%; ½W; 128 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V102 Screen grid resistor
R118	N16-R-49768-431 3RC20BF471J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF471J; 470 ohms ±5%; ½W; 15 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V102 Plate resistor
R119	For replacement use SNSN N16-R-87517-8650 3RV35038	RESISTOR, VARIABLE COMPOSITION: JAN type RV2ATRH502A; 5000 ohms ±10%; taper A; ¼W; 35 rcwv; no switch; characteristic T; ¼ in. rd shaft 1½ in. lg; 3½2 in. dia x 2¾4 in. thk excl mtg bshg and shaft; ⅜-32 thd mtg bshg 0.375 in. lg; 3 radial solder lug term; effective rotation 226° to 318°, mechanical rotation 266° to 318°; per JAN-R-94.	Microvolts control
R120	N16-R-49786-431 3RC20BF511J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF511J; 510 ohms ±5%; ½W; 16 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	L113 Damping resistor
R121	N16-R-50497-431 3RC20BF513J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF513J; 51K ±5%; ½W; 184 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	P/O V103 Grid resistor
R122	N16-R-50281-431 3RC20BF103J	RESISTOR, FIXED COMPOSITION; JAN type RC20BF103J; 10K ±5%; ½W; 71 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia. x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	P/O V103 Grid resistor
R123	N16-R-49687-431 3RC20BF271J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF271J; 270 ohms ±5%; ½W; 12 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V103 cathode resistor
R124	N16-R-49967-811 3RC20BF152K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF152K; 1500 ohms ±10%; ½W; 27 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	L115 Damping resistor
R125		Same as R103.	P/O V104 Biasing system
R126	N16-R-50416-431 3RC20BF333J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF333J; 33K ±5%; ½W; 350 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	P/O V104 Biasing system
R127	For replacement use SNSN N16-R-87519-4810 3RV35012	RESISTOR, VARIABLE: JAN type RV4ATSA502A; 5K ±10%; 2W; taper A; 100 rcwv; characteristic T; no switch; ¼ in. dia slotted shaft ½ in. lg 1⅜2 in. dia x 2½2 in. thk excl mtg bshg and shaft; ⅜-32 thd mtg bshg 0.375 in. lg; 3 radial solder lug term; effective rotation 309° to 315°; mechanical rotation 309° to 315°; per JAN-R-94.	Carrier meter zero control
R128		Same as R122.	P/O V104 Load resistor
R129	N16-R-49580-811 3RC20BF101K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF101K; 100 ohms ±10%; ½W; 7.1 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	J101 Separating resistor
R130	N16-R-72953-8841 —	RESISTOR, FIXED FILM: 500 ohms ½W, ±1%; 350 max RV, neg temp coeff; insulated; 2 leads, 1¼64 in. dia x 1⅝2 in. lg; mfg Pt #Electra type DC-½C, CWV Pt #A-5A3006-52E.	P/O Step attenuator

TABLE 7—2. TABLE OF REPLACEABLE PARTS (*Continued*)

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
R131	N16-R072869-1367 —	RESISTOR, FIXED, FILM: 61.8 ohms ±1%, ⅛W, 250 max RV; neg temp coeff, insulated, 2 leads; 5/64 in. dia x 5/32 in. lg; mfg Pt #Electra type DC-⅛; CWV Pt #A-5A1000-61R8E.	P/O Step attenuator
R132	N16-R-72952-5301 —	RESISTOR, FIXED, FILM: 495 ohms ±1%; ⅛W; 250 max RV; neg temp coeff, insulated; 2 leads; 5/64 in. dia x 5/32 in. lg; mfg Pt #Electra type DC-⅛; CWV Pt #A-5A1000-4950E.	P/O Step attenuator
R133	N16-R-72868-3271 —	RESISTOR, FIXED, FILM: 61.1 ohms ±1%; ⅛W; 250 max RV; neg temp coeff; insulated; 2 leads; 5/64 in. dia x 5/32 in. lg; mfg Pt #Electra type DC-⅛; CWV Pt #A-5A1000-61R1E.	P/O Step attenuator
R134		Same as R132.	P/O Step attenuator
R135		Same as R133.	P/O Step attenuator
R136		Same as R132.	P/O Step attenuator
R137		Same as R133.	P/O Step attenuator
R138		Same as R132.	P/O Step attenuator
R139		Same as R133.	P/O Step attenuator
R140		Same as R132.	P/O Step attenuator
R141	N16-R-72862-2323 —	RESISTOR, FIXED, FILM: 55 ohms ±1%; ⅛W; 250 max RV; neg temp coeff; insulated; 2 leads; 5/64 in. dia x 5/32 in. lg; mfg Pt #Electra type DC-⅛; CWV Pt #A-5A1000-550E.	P/O Step attenuator
R142		Same as R122.	Modulation input RF filter resistor
R143	N16-R-49688-811 3RC20BF271K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF271K; 270 ohms ±10%; ½W; 12 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V103 Screen voltage RF filter resistor
R144		Same as R113.	V104 Output RF filter resistor
R145	N16-R050400-0499 3RC42BF273K	RESISTOR, FIXED COMPOSITION: JAN type RC42BF273K; 27K ±10%; 2W; 116 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V105 Screen grid resistor
R146		Same as R114.	V105 Plate resistor
R147	N16-R-50741-811 3RC20BF274K	RESISTOR, FIXED COMPOSITION: JAN type RC20BF274K; 270K ±10%; ½W; 350 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	V105 First grid resistor
R148		Same as R147.	V105 First grid resistor
R149		Same as R116.	V105 B+ RF filter resistor
R150		Same as R104.	V105 Output RF filter resistor
R151		Same as R103.	V106 Grid resistor
R152	N16-R-73259-6084 —	RESISTOR, FIXED, FILM: 393K ohms, ±1%, ½W, 350 max RV; neg temp coeff; insulated; 2 leads; 11/16 in. dia x 13/32 in. lg; mfg Pt #Electra type DC-½C; CWV Pt #A-5A3006-3933E.	V106 400 cps Bridge resistor

R153		Same as R152.	V106 400 cps Bridge resistor
R154	N16-R-73210-1301 —	RESISTOR, FIXED, FILM: 154K ohms, ±1%; ½W; 350 max RV, neg temp coeff; insulated; 2 leads; 1/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-½C; CWV Pt #A-5A3006-1543E.	V106 1000 cps Bridge resistor
R155		Same as R154.	V106 1000 cps Bridge resistor
R156		Same as R102.	V106 Degeneration resistor
R157	N16-R-99999-141 —	RESISTOR, VARIABLE: 25,000 ohms ±10%; 2W; linear curve U; ¼ in. dia slotted shaft ⅝ in. lg; mtg bshg ½ in. lg; CTC type 95 (LT); CWV Pt #A-6A5103U-253K.	V106 Degeneration control
R158		Same as R110.	P/O V106 Cathode resistor
R159	N16-R-50362-431 3RC20BF203J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF203J; 20K ±5%; ½W; 100 rcwv; characteristic BF; insulated; resistant to humidity and salt water immersion; 0.249 in. dia x 0.468 in. lg; 2 axial wire leads; per MIL-R-11A.	P/O V106 Cathode resistor
R160		Same as R114.	V106 Plate resistor
R161		Same as R102.	V106 Plate resistor
R162		Same as R110.	V106 Cathode resistor
R163		Same as R101.	V106 Grid resistor
R164		Same as R114.	P/O V106 output divider
R165	N16-R-87849-4765 3RV45071	RESISTOR, VARIABLE COMPOSITION: JAN type RV4ATRD503A; 50K ±10%; 2W; 316 rcwv; taper A; characteristic T; no switch; ¼ in. dia rd shaft ⅞ in. lg; 1 1/32 in. dia x 2 1/32 in. thk excl mtg bshg and shaft; ⅜-32 thd mtg bshg 0.375 in. lg; 3 radial solder lug term; effective and mechanical rotation 309° to 315°; per JAN-R-94.	% MOD, AUDIO OUTPUT XTAL CAL OUT control
R166		Same as R103.	V107 Grid resistor
R167		Same as R110.	V107 Biasing resistor
R168		Same as R104.	V107 Biasing resistor
R169	N16-R-87519-4776 —	RESISTOR, VARIABLE: 5000 ohms ±10%; 2W; alternate curve U; ¼ in. dia slotted shaft ⅝ in. lg; mtg bshg ½ in. lg; CTC type 95 (LT), CWV Pt #A-6A5103U-502K.	Modulation metering sensitivity control
R170	N16-R050335-0431 3RC20BF153J	RESISTOR, FIXED COMPOSITION: JAN type RC20BF153J; 15K ohms ±5%; ½W; body dim, 0.416 in. lg x 0.161 in. dia; insulated; 2 axial wire leads; per MIL-R-11A.	P/O Mod. metering system
R171		Same as R170.	P/O Mod. metering system
R172		Same as R169.	Carrier metering sensitivity control
R173	N16-R091568-8417 —	RESISTOR, VARIABLE, WIREBOUND: 50,000 ohms ±10%; 4W; 40°C max cont operating temp; 1 21/32 in. dia case x 15/16 in. lg; ¼ in. dia rd shaft ⅞ in. lg; JAN A taper; torque — 10 oz — in. min to 20 oz —in. max; no switch; mtg bshg ⅜ in. x 32 thd x ¼ in. lg; mfg CMC Series 10; CWV Pt #A-6E6007-6503K.	Set carrier control
R174	N16-R-68322-1601 3RU18003	RESISTOR, FIXED, WIREBOUND: JAN type RU4B160J; 16 ohms ±5%; 1W; characteristic C; resistant to salt water immersion and moisture; 9/32 in. dia x 1 9/32 in. lg; 2 axial wire leads; per JAN-R-184.	Dial light dropping resistor
R175		Same as R174.	Dial light dropping resistor
R177		Same as R118.	Band F, V101 cathode resistor

TABLE 7—2. TABLE OF REPLACEABLE PARTS (*Continued*)

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
S101	N17-S061679-4689 —	SWITCH, ROTARY: 1 section; 5 positions; ceramic body; 7/8 in. lg x 1 5/16 in. h; 1/4 in. dia shaft 1 7/16 in. lg; mfg COC; CWV Pt #A-47F1038-1.	Carrier range switch
S102	N17-S066056-9683 —	SWITCH, ROTARY: 4 sections; 5 positions; 2 poles per section on 3 sections; 2 stator contacts on 1 section; ceramic body; 1 5/16 in. w x 1 1/2 in. h; 1/4 in. dia shaft, 1/2 in. lg; bshg 3/8-32 x 3/8 in. lg; mfg CBN; CWV Pt #B-47F1037-1.	MOD, XTAL & METER SELECTOR
TB101	# —	BOARD, TERMINAL: Melamine glass fibre; type GMG per spec 17P25; 1/16 in. thk irregular shape; 7 3/4 in. lg x 3 5/16 in. w o/a; five .136 in. dia mtg holes; fifty-nine .096 in. dia term mtg holes; CWV Pt #C-73C1122-1.	P/O Z101
TB102	# —	STRIP, TERMINAL: Melamine glass fibre; type GMG per spec 17P25; 1/16 in. thk; 1 1/8 in. lg x 29/32 in. w; five .110 dia holes for terminal lugs; two .1065 in. dia holes on .625 in. mtg/C; CWV Pt #A-73C1125-1.	Mounting board for feed-thru terminals on main casting
TB103	# —	BOARD, TERMINAL: Melamine glass fibre; type GMG per spec 17P25; 1/16 in. thk; irregular shape; 3 3/16 in. lg x 2 11/16 in. w o/a; sixteen .096 in. dia holes for mounting terminals; one .187 in. dia hole for mounting; two .128 in. dia holes on 1.750 in. mtg/C; CWV Pt #B-73C1131-1.	P/O Z108
TB104	# —	BOARD, TERMINAL: Melamine glass fibre; type GMG per spec 17P25; 3/32 in. thk; irregular shape; 2 3/4 in. lg x 1 13/16 in. w o/a; six .096 term. mtg holes; one .128 in. dia mtg hole; one .185 in. dia mtg hole, 3/8 in. dia x .038 dp C bore; CWV Pt #A-73G1136-1.	P/O Z108
TB107	# —	BOARD ASSEMBLY: Melamine glass fibre; irregular shape; 2 3/4 in. lg x 1 13/16 in. w o/a; six turret terminals for mtg components; stopnut for mtg board; CWV Pt #B-90B1349-501.	Supports C139, L116, L117 and L118
TB108	# —	BOARD ASSEMBLY: Melamine glass fibre; irregular shape; 3 3/16 in. lg by 2 11/16 in. w o/a; 13 turret terminals, 3 double end turret terminals for mtg components; CWV Pt. #B-90B1355-501.	Supports C130, C131, C132, C133, C135, L112, L113, L114, L115, R116, R117, R120, R121, R122, R123 and R124
TB109	# —	BOARD ASSEMBLY: Melamine glass fibre; irregular shape; 7 3/4 in. lg by 3 5/16 in. w o/a; fifty-nine turret terminals for mtg components; CWV Pt #C-90B1360-501.	P/O modulation and metering unit
TB110	# —	TERMINAL STRIP ASSEMBLY: Melamine glass fibre; 1 1/8 in. lg by 29/32 in. w; five terminal lugs; two pem nuts for mtg boards; CWV Pt #B-90B1398-501.	RF amplifier power supply terminal board
V101	N16-T-56185 2J6AH6	ELECTRON TUBE: JAN type 6AH6; RF pentode; per MIL-E-1B.	Carrier oscillator
V102		Same as V101.	Buffer stage
V103	N16-T-56177 2J6AG7	ELECTRON TUBE: JAN type 6AG7; power pentode; per MIL-E-1B.	Output amplifier
V104	N16-T-75726 2J5726/6AL5W	ELECTRON TUBE: JAN type 5726; double-diode; per MIL-E-1B.	Carrier volt meter
V105	N16-T-75750 2J5750/6BE6W	ELECTRON TUBE: JAN type 5750; pentagrid; per MIL-E-1B.	Crystal calibrator

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

V106	N16-T-75814-5 2J5814A	ELECTRON TUBE: JAN type 5814A; double-triode; per MIL-E-1B.	Modulation oscillator
V107		Same as V101.	Modulation cathode follower
V108	N-16-T-52001-3 2JOA2WA	ELECTRON TUBE: JAN type OA2WA; voltage regulator; per MIL-E-1B.	Voltage stabilizer
W104	Shop Manufacture —	CABLE ASSEMBLY, RF: JAN type RG-58C/U cable 6″ lg; two JAN type UG-88/U connectors, one at each end; Navy type CG-409/U.	RF output cable
W105		Same as W104.	RF output cable
W106	Shop Manufacture —	CABLE ASSEMBLY, RF: JAN type RG-58C/U cable 48″ lg; two JAN type UG-88/U connectors, one at each end; Navy type CG-409/U.	RF output cable
W107	N15-C-12200-580 1F425-58C	CABLE, RF: JAN type RG-58C/U; coaxial; 50-ohms nom impedance, 28.5 uuf/ft nom capacitance, 1900v rms; inner conductor, one, stranded, copper, tinned, (19) #34 AWG strands; polyethylene dielectric; outer conductor, tinned, copper braid; synthetic resin jacket per JAN-C-17A.	P/O W104, W105 and W106
W108	GX15-C-10340-120 1B3016-2.21	CABLE, POWER, ELECTRICAL: Jan type DCOP-2; 2 conductor; each conductor #16 AWG; copper; stranded, (16) #30 AWG strands/conductor; synthetic insulated; inner braid optional, filler optional, binder, polychloroprene sheath; 1500v test; round; 0.330 in. outside dia; per MIL-C-915A.	AC power interconnecting cable
W109	Fabricated locally from bulk material under SNSN N15-C027980-055D	CABLE, POWER, ELECTRICAL: Type SJ; 3 conductor; #18 AWG; stranded, (16) strands #30 AWG, rubber insulation; rubber jacketed; 300 volts; six ft lg, 0.330 in. OD; mfg Carol Cable Co. #1303.	P/O AC power input cable assembly W132
W132	Assemble from component parts	CABLE ASSEMBLY, POWER, ELECTRICAL: type SJ; (3) #18 AWG, stranded (#30 AWG), copper conductors; rubber insulation; rubber jacketed; 300 volts; 6 ft o/a; termination data, (1) UP-121/M on one end, other not terminated; CWV Pt #B-90B1559-501.	AC line cable
XF101	N17-F-74267-6501 3Z3285-6.6	HOLDER, FUSE: Extractor post type; for single 1¼ in. lg x ¼ in. dia cartridge fuse; black bakelite; 250 volts at 15 amp; 2$^{1}/_{16}$ in. lg x $^{11}/_{16}$ in. dia o/a; ½-24 x ½ lg threaded bakelite body for panel-hole mtg $^{3}/_{32}$ hole drilled through cap; mfg CFA type HKP-H; CWV Pt #A-43B1004-2.	Holder for fuse F101
XF102		Same as XF101.	Holder for fuse F102
VI101	N17-L076657-2302 —	LAMPHOLDER: JAN type LH64PR5; accommodates miniature bayonet base lamp; max electrical rating 125 v, ½W; built-in resistor; plain red jewel; for $^{11}/_{16}$ in. mtg hole; 2 solder lug terminals; per MIL-L-3661.	Holder for I101
XV101	N16-S-62603-6700 2Z8677.99	SOCKET, TUBE: JAN type TS102C01; ceramic; 7 contact miniature; brass saddle, top mtg; two $^{1}/_{8}$ in. dia holes on $^{7}/_{8}$ in. mtg/c; round ceramic body; .800 in. dia x 1$^{1}/_{8}$ in. lg x $^{25}/_{32}$ in. h excl term; brass saddle for mtg socket and for mtg twist lock shield; per JAN-S-28A.	Tube socket for V101
XV102		Same as XV101.	Tube socket for V102
XV103	N16-S-63515-4162 2Z8670.39	SOCKET, TUBE: JAN type TS101C02; ceramic; octal; brass saddle, bottom mtg; two 6-32 tapped mtg bshgs; round ceramic body 1$^{7}/_{64}$ in. dia; 1$^{7}/_{8}$ in. lg x 1$^{3}/_{8}$ in. w x $^{11}/_{16}$ in. h excl term; per JAN-S-28A.	Tube socket for V103
XV104		Same as XV101.	Tube socket for V104
XV105		Same as XV101.	Tube socket for V105
XV106	N16-S-64063-6713 2Z8679.30	SOCKET, TUBE: JAN type TS103P01; phenolic; noval; brass saddle; top mtg; two .125 in. dia holes on 1.125 in. mtg/C; round phenolic body; .940 in. dia x 1$^{3}/_{8}$ in. lg x $^{25}/_{32}$ in. h excl term; brass saddle for mtg socket and mtg twist lock shield; per JAN-S-28A.	Tube socket for V106

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
XV107	N16-S-62603-6702 2Z8677.94	SOCKET, TUBE: JAN type TS102P01; phenolic; 7-contact miniature; brass saddle top mtg; two 1/8 in. dia holes on 7/8 in. mtg/C; round phenolic body; .800 in. dia x 1 1/8 in. lg x 25/32 in. h excl term; brass saddle for mtg socket and for mtg twist lock shield; per JAN-S-28A.	Tube socket for V107
XV108		Same as XV107.	Tube socket for V108
XY101	N16-S-54287-5051 2Z8761-60	SOCKET, CRYSTAL: Copper contacts; silver plated tabs; steatite insulation; 55/64 in. lg x 3/8 in. w x 3/8 in. h excluding terminals; mfg CEB type #9006; CWV Pt #A-18C1001-1.	Socket for Y101
Y101	N16-C-96783-1861 2X209-1000	CRYSTAL UNIT: JAN type CR-18/U; quartz; one quartz plate, nominal frequency 1 mc; two .05 in. dia contact pins spaced 0.486 in. C to C on bottom; rectangular metal body 3/4 in. lg x 11/32 in. w by 3/4 in. h; not adjustable.	Crystal calibrator (V105) crystal
Z101	Assemble from component parts —	MODULATOR UNIT ASSEMBLY: C/O C159, C160, C161, C162, C163, C164, C165, C167, CR101, CR102, L124, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163, R164, R165, R166, R167, R168, R169, R170, R171, R172, R173, S102, TB101, and XV106; CWV Pt #D-90B1514-501.	Audio section for providing modulation signal
Z102	Assemble from component parts —	DIAL COVER ASSEMBLY: C/O E121, E122, E125, E126, E127, E128, E129, N101, N105, R174, R175, Z103, and Z111; CWV Pt #D-90B1397-501.	Front panel frequency dial cover
Z103	Assemble from component parts —	CONTACT AND SUPPORT ASSEMBLY: C/O E130, E131, K101 and K102; CWV Pt #B-90B1397-501.	Contact and support assembly for front panel dial lights
Z104	Assemble from component parts —	TURRET ASSEMBLY: C/O E130 thru E162, C101, C102, C103, C104, C105, C106, C107, C108, C109, C110, C111, C112, C113, C114, C115, C116, L101, L102, L103, L104, L105, L106, L107, L108, R101, R102, R103, R104, R105, R106, R107, R108, R109, R110, R111, R112, R113 and R177; CWV Pt #E-90B1397-501.	P/O RF frequency determining network
Z105	# —	DIAL SHUTTER & HUB ASSEMBLY: C/O 0105 and 0106; CWV Pt #B-90B1326-501.	Frequency scale shutter
Z106	# —	SPRING ASSEMBLY, DETENT: C/O 0107 and 0136; CWV Pt #B-90B1328-501.	Turret selector detent
Z107	Assemble from component parts —	OSCILLATOR ASSEMBLY, CRYSTAL: C/O C155, C156, C157, C158, E163, L121, R145, R146, R147, R148, XV105, XY101 and Y101; CWV Pt #D-90B1353-501.	Crystal calibrator
Z108	Assemble from component parts —	AMPLIFIER ASSEMBLY, RF: C/O C131, C132, C134, C136, C137, C138, C139, C140, L113, L114, L116, L117, L118, R114, R115, R117, R119, R122, R125, R126, R127, R128, S101, TB103, TB104, XV102, XV103, XV104; CWV Pt #D-90B1395-501.	VTVM, buffer and output amplifiers
Z109	For Reference Only	BLOCK AND SPRING ASSEMBLY: P/O contact disc assembly C-90B1419-501; CWV Pt #B-90B1393-501.	Fixed contact for turret selector switch
Z110		Same as Z109.	Fixed contact for turret selector switch
Z111		Same as Z109.	Fixed contact for turret selector switch
Z112		Same as Z109.	Fixed contact for turret selector switch

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

Z114	# —	WORM GEAR ASSEMBLY: CWV Pt #B-90B1433-501.	P/O main tuning capacitor (C123) drive
Z115	# —	OSCILLATOR TUBE BRACKET ASSEMBLY: C/O C120, C121, C122, C124, XV101; CWV Pt #B-90B1477-501.	Carrier oscillator
Z116	# —	SPUR GEAR ASSEMBLY: CWV Pt #B-90B1475-501.	P/O main tuning capacitor (C123) drive
Z123	# —	FILTER BOX ASSEMBLY: C/O C168, C169, L122 and L123; CWV Pt #B-90D1092-501.	AC power input filter
PS101	Assemble from component parts	POWER SUPPLY: Navy type PP-1205/URM-25E.	
C201	N16-C-49958-5143 3DB4-442	CAPACITOR, FIXED, PAPER: JAN type CP40C2DF405K; 4 uf ±10%; 600 vdcw; characteristic ltr D; hermetically sealed metal case; grounded circuit; uninsulated; 1½ in. dia x 4½ in. lg excl mtg bshg and term; ¾-16 thd mtg bshg ½ in. lg; one radial ground lug; per MIL-C-25A.	Power supply filter capacitor
C202		Same as C201.	Power supply filter capacitor
C203		Same as C201.	Power supply filter capacitor
C204	N16-C-45963-8500 —	CAPACITOR, FIXED PAPER: 0.15 uf ±10%; 400 vdcw; characteristic ltr F; hermetically sealed; wax impregnated; insulating sleeve; ½ in. dia x 1 9/16 in. lg; 2 axial wire leads; mfg CMR type 354H-505-10; CWV Pt #A-1E3155-0R15K.	L201 resonating capacitor
J201	N17-C-73425-9485 2Z3022-156	CONNECTOR, RECEPTACLE: two flat polarized blades; 21/32 in. dia x ½ in. h excl contacts and term; 730 v rms; 10 amp cylindrical black bakelite body; flange type metal mtg brackets w/two .152 in. dia mtg holes on 3/32 in. mtg/C; 2 solder lug term.; mfg CJC Part #P-302-AB; CWV Pt #A-17E1001-2.	AC input receptacle on power supply sub-chassis
J202	N17-C-73224-1604 2Z3067-38	CONNECTOR, RECEPTACLE: 6 rectangular polarized female contacts; straight; 1 in. lg x 11/16 in. w x ½ in. h excl term.; rectangular black, bakelite body; flange type metal mtg brackets w/two 0.146 in. dia holes on 1 in. mtg/C; 6 solder lug term; Mfg CJC #S-306-AB; CWV Pt#A-18E1001-6.	Power supply output receptacle
L201	N16-R-29253-7842 —	CHOKE, FILTER: 11 h ±10%; 75 ma; 400 ohms max, dc resistance; 630 v rms test; hermetically sealed metal case; 1⅞ in. lg x 1⅞ in. w x 2½ in. h excl term; four #6-32 x ⅜ in. lg mtg studs on 1½ in. x 1½ in. mtg/C; two solder lug terminals on bottom of case; spec MIL-T-27, grade 1, class A, family 04; mfg Berkshire Transformer Co. type #1802; CWV Pt #C-12B1017-1.	Power supply filter
R201	N16-R-66167-9234 3RW27354	RESISTOR, FIXED WIREWOUND: JAN type RW21J312; 3100 ohms ±5%; 12.5W; characteristic J; untapped; 3¼ in. lg x 21/32 in. h x 1 3/16 in. w excl term; stack mtg; two 0.196 in. dia holes on 2¾ in. mtg/C; two tab term. per MIL-R-26B.	Power supply series dropping resistor
T201	N17-T074161-7993 —	TRANSFORMER, POWER: Filament and plate type; 115v 50/1000 cycles; single phase; two output windings; Sec. #1 — 6.5 v at 4.5 amps; Sec. #2 — 450 vct at 75 ma; hermetically sealed; rectangular case; 3 in. lg x 2⅞ in. w x 3¾ in. h excl term; seven ½ in. high stand-off term; four #8-32 x 11/32 in. lg mtg bolts on 2 7/16 in. x 2⅜ in. mtg/C; spec MIL-T-27, Grade 1, class A, family 03; mfg Berkshire Transformer Co. #1801; CWV Pt #C-9A1021-1.	Power transformer
V201	N16-T-56840-50 2J6X4W	ELECTRON TUBE: JAN type 6X4W; full-wave high-vacuum rectifier per MIL-E-1B.	Power supply rectifier
XV201		Same as XV107.	Tube socket for V201
Z120		ATTENUATOR, FIXED: JAN Type CN-284/U; CWV Pt #C-90B1358-501.	

Low failure item — if required requisition from ESO referencing NavShips 900,180A.

TABLE 7–2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
J301	N17-C-73108-3039 2Z 7390-625B	CONNECTOR, RECEPTACLE, ELECTRICAL: JAN type UG-625B/U; (1) rd female contact rated at 50 ohms nom impedance, 500 v rms peak; low loss plastic; straight shape; o/a dim., excl term, 0.783 in. lg x ½ in. w across hex flats; bayonet latch type; single thru hole mtg (c/o ⅜ in. dia "D" shaped hole); Signal Corp dwg SC-DL-77093.	Fixed attenuator CN-284/U connector
J302		Same as J301.	Connector for (5:1) fixed attenuator CN-284/U
R301	For replacement use N16-R-72882-1459 —	RESISTOR, FIXED COMPOSITION: 75 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 1/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-750E.	P/O 5:1 fixed attenuator CN-284/U
R302	N16-R-72904-3991 —	RESISTOR, FIXED COMPOSITION: 120 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 1/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-121E.	P/O 5:1 fixed attenuator CN-284/U
R303		Same as R301.	P/O 5:1 fixed attenuator CN-284/U
Z122	Assemble from component parts —	ATTENUATOR, FIXED: 10 to 1 voltage ratio; Navy type CN-283/U; CWV Pt #C-90B1358-503.	
J401		Same as J301.	Connector for fixed attenuator CN-283/U
J402		Same as J301.	Connector for fixed attenuator CN-283/U
R401	N16-R-72868-3301 —	RESISTOR, FIXED COMPOSITION: 61.1 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 1/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-61R1E.	P/O fixed attenuator CN-283/U
R402	N16-R-72924-8120 —	RESISTOR, FIXED COMPOSITION: 247.5 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 1/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-247R5E.	P/O fixed attenuator CN-283/U
R403		Same as R401.	P/O fixed attenuator CN-283/U
Z117		NETWORK, IMPEDANCE MATCHING: Navy type CU-411/URM-25E; CWV Pt #B-90B1495-501.	
J501		Same as J301.	Connector for network, impedance matching CU-411/URM-25E
J502		Same as J301.	Connector for network, impedance matching CU-411/URM-25E
R501	N16-R-72857-2333 —	RESISTOR, FIXED COMPOSITION: 50 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 1/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-51E.	P/O network, impedance matching CU-411/URM-25E

Z119	Assemble from component parts	LEAD, TEST: Navy type CX-2962/U; CWV Pt #B-90B1485-501.	
C601	N16-C-45773-6125 —	CAPACITOR, FIXED, PAPER: 0.1 uf ±10%; 400 vdcw; characteristic ltr F; hermetically sealed; wax impregnated; insulating sleeve; .400 in. dia x 15/16 in. lg; 2 axial wire leads; mfg CGF type XFS-1816; CWV Pt #A-1E3152-0R1K.	P/O Test lead CX-2962/U
C602	N16-CO30188-5006 3K2051122	CAPACITOR, FIXED, MICA: JAN type CM20B511J; 510 uuf ±5%; 500 vdcw; characteristic ltr B; molded phenolic case; 5/64 in. lg x 15/32 in. w x 1/32 in. thk; 2 axial wire leads; per MIL-C-5A.	P/O Test lead CX-2962/U
J601		Same as J301.	Connector for test lead CX-2962/U
Z118	Assemble from component parts —	DUMMY, LOAD ELECTRICAL: Navy type DA-106/URM-25E; CWV Pt #B-90B1496-501.	
C701	N16-C-29265-3006 3K2020142	CAPACITOR, FIXED, MICA: JAN type CM20D201J; 200 uf ±5%; 500 vdcw; characteristic ltr D; molded phenolic case; 5/64 in. lg x 15/32 in. w x 1/32 in. thk; 2 axial wire leads; per MIL-C-5A.	P/O Dummy load electrical DA-106/URM-25E
C702	N16-C-29898-3606 3K2039142	CAPACITOR, FIXED, MICA: JAN type CM20D391J; 390 uuf ±5%; 500 vdcw; characteristic ltr D; molded phenolic case; 5/64 in. lg x 15/32 in. w x 1/32 in. thk; 2 axial wire leads; per MIL-C-5A.	P/O Dummy load electrical DA-106/URM-25E
J701	—	Same as J301.	Connector for dummy load, electrical DA-106/URM-25E
J702		Same as J301.	Connector for dummy load, electrical DA-106/URM-25E
L701	N16-C076468-5652 —	CHOKE, RADIO FREQUENCY: one winding; single layer wound; 48 turns, #30 AWG enameled copper wire, closewound; inductance 20 uh ±10% at 2.5 mc; CWV Pt #B-12B1019-501.	P/O Dummy load, electrical DA-106/URM-25E
R701	N16-R-72943-9815	RESISTOR, FIXED COMPOSITION: 400 ohms ±1%; ½W; 350 max rv; insulated; 2 leads, neg temp coeff; 11/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-42E.	P/O Dummy load, electrical DA-106/URM-25E
Z121	Assemble from component parts —	NETWORK, IMPEDANCE MATCHING: Navy type CU-410/URM-25E; CWV Pt #C-90B1358-502.	
J801		Same as J301.	P/O Impedance matching network CU-410/URM-25E
J802		Same as J301.	P/O Impedance matching network CU-410/URM-25E
P801	N17-C-67990-2447 2Z308-201	ADAPTER, CONNECTOR: JAN type UG-201/U, BuShips dwg RE49R335; male one end, female other end; coax male type N at one end, coax female type BNC other end; straight type; adapts female type N to male type BNC connector; 3/4 in. dia x 1 1/16 in. lg o/a; 52 ohms impedance; cylindrical brass silver pl; molded polystyrene insert.	Coaxial adapter N-BNC
P802	N17-C-67988-5260 2Z308-273	ADAPTER, CONNECTOR: JAN type UG-273/U; 2 contacts; 2 connector mating ends; contact data, one male contact for UHF type connector one end, one female slotted contact for BNC type connector other end, 50 ohms nom nonconstant frequency impedance characteristic; plastic insert; straight shape; o/a dim. excl contacts, terminals, 1 7/32 in. lg x 2 3/32 in. OD; 5/8-24 NEF 2 coupling nuts one end, bayonet type locking other end; mounts between associated connectors; BuShips dwg #RE49F389F.	Coaxial adapter BNC to UHF

TABLE 7—2. TABLE OF REPLACEABLE PARTS *(Continued)*

REF DESIG	STOCK NUMBERS (1) STANDARD NAVY (2) SIGNAL CORPS (MARINE CORPS)	NAME AND DESCRIPTION	LOCATING FUNCTION
R801	N16-R-072862-4572 —	RESISTOR, FIXED COMPOSITION: 57.1 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 11/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-57R1E.	P/O Impedance matching network CU-410/URM-25E
R802	N16-R-072934-5574 —	RESISTOR, FIXED COMPOSITION: 347.5 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 11/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-347R5E.	P/O Impedance matching network CU-410/URM-25E
R803	N16-R-072889-7725 —	RESISTOR, FIXED COMPOSITION: 86.5 ohms ±1%; ½W; 350 max rv; neg temp coeff; insulated; 2 leads; 11/64 in. dia x 15/32 in. lg; mfg Pt #Electra type DC-1/2C; CWV Pt #A-5A3006-86R5E.	P/O Impedance matching network CU-410/URM-25E

TABLE 7–3. CROSS REFERENCE PARTS LISTS

JAN OR AWS DESIGNATION	SYMBOL DESIG.
CC21CH120J	C157
CC21CK020C	C119
CM15B101K	C111
CM15B151K	C109
CM15B221K	C107
CM15B331K	C105
CM15B391K	C103
CM15B511J	C101
CM15B560K	C113
CM20B271J	C156
CM20B511J	C602
CM20D201J	C701
CM20E391J	C702
CM25D102G	C160
CM35E103J	C135
CN22AX103M	C130
CN43EE104M	C162
CN43EY204M	C166
CP16A3HB203M	C133
CP40C2DF405K	C201
CR-18/U	Y101
CV11A120	C102
CV12A250	C158
DCOP-2	W108
IN34A	CR101
LH64PR5	XI101
MR26W100DCUAR	M101
OA2WA	V108
RC20BF101K	R129
RC20BF102K	R110
RC20BF103J	R122
RC20BF103K	R112
RC20BF104K	R114
RC20BF105K	R101
RC20BF124K	R107
RC20BF152K	R124
RC20BF153J	R170
RC20BF161J	R115
RC20BF183K	R106
RC20BF203J	R159
RC20BF222K	R116
RC20BF223K	R104
RC20BF271J	R123
RC20BF271K	R143
RC20BF274K	R147
RC20BF333J	R126
RC20BF333K	R117
RC20BF394K	R105
RC20BF471J	R118
RC20BF472K	R113
RC20BF473K	R102
RC20BF474K	R103
RC20BF511J	R120
RC20BF513J	R121
RC20BF682K	R108
RC42BF273K	R145
RG-58C/U	W107
RU4B160J	R174
RV2ATRH502A	R119
RV4ATRD503A	R165
RV4ATSA502A	R127
RW21J312	R201
TS101C02	XV103
TS102C01	XV101
TS102P01	XV107
TS102U01	E104
TS102U02	E101
TS102U03	E108
TS103P01	XV106
TS103U02	E106
UG-88/U	P103
UG-201/U	P801
UG-273/U	P802
UG-290A/U	J101
UG-625A/U	J301
UP-121/M	P110
6AG7	V103
6AH6	V101
6X4W	V201
5726	V104
5750	V105
5814A	V106

NAVY TYPE NUMBER	SYMBOL DESIG.
AN931-A3-5	E174
CG-409/U (6")	W104
CG-409/U (48")	W106
CN-283/U	
CN-284/U	
CU-410/URM-25E	
CU-411/URM-25E	
CW-123A/U	E109
CW-355/URM-25E	A108
CX-2962/U	
DA-106/URM-25E	
PP-1205/URM-25E	PS101
SG-111/URM-25E	

NAVY/BUSHIPS DWG. NUMBER	SYMBOL DESIG.
RE49F335	P801
RE49F389F	P802

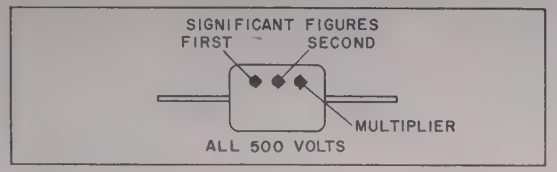
SIGNAL CORPS DWG. NUMBER	SYMBOL DESIG.
SC-D-72292	J101
SC-D-72305	J301
SC-DL-77093	J301

STANDARD NAVY STOCK NUMBER	SYMBOL DESIG.
GM17-F-16302-80	F101
GM17-L-6543-100	E121
GX15-C-10340-120	W108
N15-C-12200-580	W107
N16-A098026-4416	AT101
N16-C-11008-500	C133
N16-C-15432-5867	C119
N16-C-15953-2999	C157
N16-C-18211-7955	C120
N16-C-18653-9300	C170
N16-C-18659-4509	C122
N16-C-18659-7792	C125
N16-C-18659-7793	C127
N16-C-19781-4720	C132
N16-C-27766-6050	C113
N16-C-28557-9050	C111
N16-C-28979-9450	C109
N16-C-29265-3006	C701
N16-C-29375-6450	C107
N16-C029608-2206	C156
N16-C-29718-5792	C105
N16-C-29898-3606	C702
N16-C-29903-2862	C103
N16-C-30188-3635	C101
N16-C030188-5006	C602
N16-C-31080-2214	C160
N16-C-33617-4758	C135
N16-C-42764-8898	C130
N16-C-45773-6125	C601
N16-C-45805-3601	C134
N16-C-45805-6260	C162
N16-C-45963-8500	C204
N16-C-46182-8905	C166
N16-C-49958-5143	C201
N16-C-63934-8129	C102
N16-C-64041-4565	C158
N16-C-96783-1861	Y101
N16-C046343-9317	C121
N16-C061909-8566	C123
N16-G-900104-659	E174
N16-K-700094-251	E119
N16-R-29253-7842	L201
N16-R-49580-811	R129
N16-R-49633-431	R115
N16-R-49687-431	R123
N16-R-49688-811	R143
N16-R-49768-431	R118
N16-R-49786-431	R120
N16-R-49922-811	R110
N16-R-49967-811	R124
N16-R-50012-811	R116
N16-R-50129-811	R113
N16-R-50201-811	R108
N16-R-50281-431	R122
N16-R-50282-811	R112
N16-R-50354-811	R106
N16-R-50362-431	R159
N16-R-50372-811	R104
N16-R050400-0499	R145
N16-R-50416-431	R126
N16-R-50417-811	R117
N16-R-50480-811	R102
N16-R-50497-431	R121
N16-R-50633-811	R114
N16-R-50651-811	R107
N16-R-50741-811	R147
N16-R-50786-811	R105
N16-R-50822-811	R103
N16-R-50975-811	R101
N16-R-66167-9234	R201
N16-R-68322-1601	R174
N16-R-72857-2333	R501
N16-R-72862-2323	R141
N16-R-72868-3271	R133
N16-R-72868-3301	R401
N16-R072869-1367	R131
N16-R-72882-1459	R301
N16-R-72904-3991	R302
N16-R-72924-8120	R402
N16-R-72943-9815	R701
N16-R-72952-5301	R132
N16-R-72953-8841	R130
N16-R-73210-1301	R154
N16-R-73259-6084	R152
N16-R-87517-8650	R119

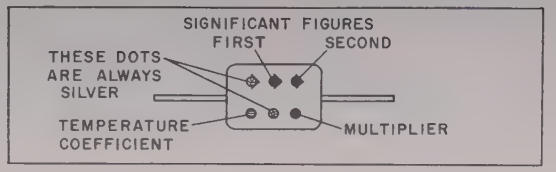
STANDARD NAVY STOCK NUMBER	SYMBOL DESIG.	SIGNAL CORPS (MARINE CORPS) STOCK NUMBER	SYMBOL DESIG.	SIGNAL CORPS (MARINE CORPS) STOCK NUMBER	SYMBOL DESIG.
N16-R-87519-4776	R169	1B3016-2.21	W108	3K1539121	C103
N16-R-87519-4810	R127	1F425-58C	W107	3K1551122	C101
N16-R-87849-4765	R165	2J0A2WA	V108	3K1556021	C113
N16-R-99999-141	R157	2J1N69	CR101	3K2020142	C701
N16-R-072862-4572	R801	2J6AG7	V103	3K2027122	C156
N16-R072889-7725	R803	2J6AH6	V101	3K2039142	C702
N16-R072934-5574	R802	2J6X4W	V201	3K2051122	C602
N16-R091568-8417	R173	2J5726/6AL5W	V104	3K2510243	C160
N16-S-34520-3862	E104	2J5750/6BE6W	V105	3K3510352	C135
N16-S-34557-8351	E101	2J5814A	V106	3RC20BF101K	R129
N16-S-34576-6513	E106	2X209-1000	Y101	3RC20BF102K	R110
N16-S-34607-6039	E108	2Z308-201	P801	3RC20BF103J	R122
N16-S-54287-5051	XY101	2Z308-273	P802	3RC20BF103K	R112
N16-S-62603-6700	XV101	2Z3022-156	J201	3RC20BF104K	R114
N16-S-62603-6702	XV107	2Z3023-169	P110	3RC20BF105K	R101
N16-S-63515-4162	XV103	2Z3063-9	P101	3RC20BF124K	R107
N16-S-64063-6713	XV106	2Z3067-38	J202	3RC20BF152K	R124
N16-T-52001-3	V108	2Z3350-123	E109	3RC20BF153J	R170
N16-T-56177	V103	2Z5888-5	I101	3RC20BF161J	R115
N16-T-56185	V101	2Z5932	E121	3RC20BF183K	R106
N16-T-56840-50	V201	2Z7228-17	P102	3RC20BF203J	R159
N16-T-75726	V104	2Z7390	J101	3RC20BF222K	R116
N16-T-75750	V105	2Z7390-88	P103	3RC20BF223K	R104
N16-T-75814-5	V106	2Z7390-625B	J301	3RC20BF271J	R123
N17-C-67988-5260	P802	2Z8304.57	E104	3RC20BF271K	R143
N17-C-67990-2447	P801	2Z8304.275	E106	3RC20BF274K	R147
N17-C-71125-1404	P101	2Z8304.276	E101	3RC20BF333J	R126
N17-C-71408-5333	P103	2Z8304.277	E108	3RC20BF333K	R117
N17-C-71515-8118	P102	2Z8670.39	XV103	3RC20BF394K	R105
N17-C-73108-3039	J301	2Z8677.94	XV107	3RC20BF471J	R118
N17-C-73224-1604	J202	2Z8677.99	XV101	3RC20BF472K	R113
N17-C-73425-9485	J201	2Z8679.30	XV106	3RC20BF473K	R102
N17-C-780616-281	E129	2Z8761-60	XY101	3RC20BF474K	R103
N17-C-945001-850	E112	3DA10-447	C130	3RC20BF511J	R120
N17-C-99999-892	E109	3DA100-838	C162	3RC20BF513J	R121
N17-C073108-2878	J101	3DA200-54	C166	3RC20BF682K	R108
N17-C071464-8682	P110	3DB4-442	C201	3RC20BF273K	R145
N17-C098378-7237	O137	3D9002-38	C119	3RU18003	R174
N17-F-74267-6501	XF101	3D9012-38	C157	3RV35012	R127
N17-K-700061-468	E113	3D9012V-19	C102	3RV35038	R119
N17-M027189-2174	M101	3D9025V-88	C158	3RV45071	R165
N17-P-69136-2412	E120	3D9150-117	C109	3RW27354	R201
N17-S061679-4689	S101	3K1510121	C111	3Z2601.16	F101
N17-S066056-9683	S102	3K1522121	C107	3Z3285-6.6	XF101
N17-T074161-7993	T201	3K1533121	C105	6Z4872	E174

CAPACITOR COLOR CODES

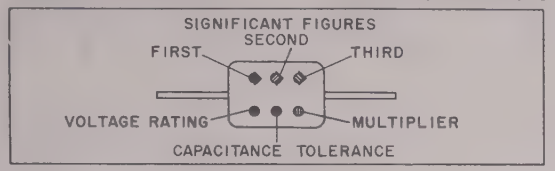
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



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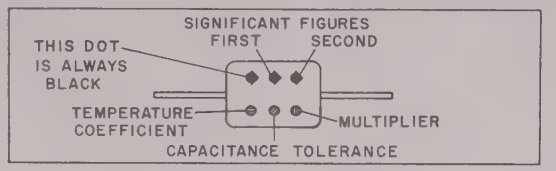
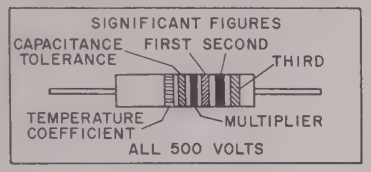
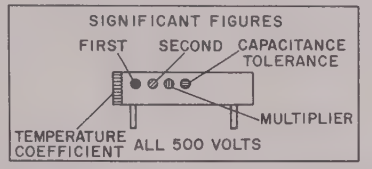


RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS

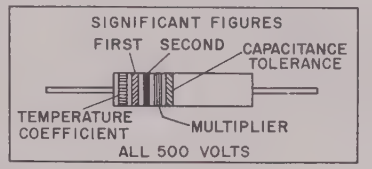


JAN COLOR CODE FOR FIXED-DIELECTRIC CAPACITORS

RADIAL TYPE NON-INSULATED



AXIAL TYPE INSULATED



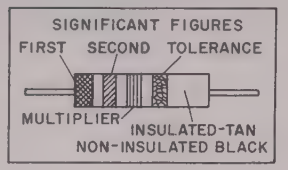
RMA: RADIO MANUFACTURES ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTORS				CAPACITORS				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	MULTIPLIER			VOLTAGE RATING	TEMPERATURE COEFFICIENT
				RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC		
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1,000	3	ORANGE	1,000	1,000	1,000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		.001	800	
	1,000,000,000	9	WHITE	1,000,000,000		.01	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

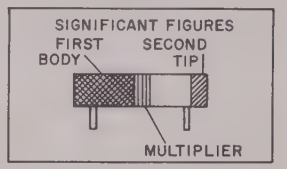
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE

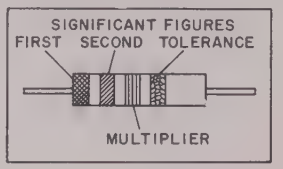


RADIAL TYPE



JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED

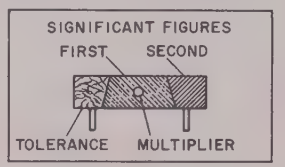


TABLE 7–4. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

TABLE 7—5. LIST OF MANUFACTURERS

PREFIX AND/OR ABBREVIATION	NAME	ADDRESS
CAW	Aerovox Corp.	742 Belleville Avenue New Bedford, Mass.
	Atlantic India Rubber Co.	571 W. Polk Street Chicago, Ill.
	Berkshire Transformer Co.	15 South Avenue New Milford, Conn.
CBH	Boston Gear Works	10 Hayward Street N. Quincy, Mass.
CFA	Bussman Mfg. Co.	2538 W. University St. St. Louis, Mo.
CAMQ	Cambridge Thermionic Corp.	445 Concord Avenue Cambridge, Mass.
	Carol Cable Co.	Pawtucket, R.I.
CBN	Central Radio Laboratory Division of Globe Union	900 E. Keefe Avenue Milwaukee, Wisconsin
CTC	Chicago Telephone Supply Co.	Elkhart, Indiana
CMC	Clarostat Manufacturing Co.	285-287 N. 67th St. Brooklyn, N.Y.
	Commercial Plastics Co.	Chicago, Illinois
CAHW	Crowe Nameplate Co.	1765 Grace Street Chicago, Illinois
CAYZ	Dial Light Co. of America Inc.	900 Broadway New York, N.Y.
CEB	Eby, Hugh H.	4700 Stenton Avenue Philadelphia, Pa.
	Electra Manufacturing Co.	2537 Madison Avenue Kansas City, Mo.
CER	Erie Resistor Corp.	644 W. 12th Street Erie, Pa.
	Garde Mfg. Co.	Providence, R.I.
	General Electric Co.	Nela Park Cleveland, Ohio
CAG	General Radio Co.	30 State Street Cambridge, Mass.
CGF	Gudeman Co.	361 W. Superior Street Chicago, Illinois
CWV	Harvey-Wells Electronics, Inc.	North Street Southbridge, Mass.
	Herzog Miniature Lamp Works	New York, N.Y.
CJC	Jones, Howard	2300 W. Wabansia Avenue Chicago, Illinois
CLF	Littelfuse Laboratories, Inc.	4765 Ravenswood Avenue DesPlaines, Illinois
CMA	Mallory, P. R., Co., Inc.	1941 Thomas Street Indianapolis, Ind.
CMR	Micamold Radio Corp.	1087-1095 Flushing Ave. Brooklyn, N.Y.
	Minor Rubber Co.	Ackerman Street Bloomfield, N.J.
CBIT	Mueller Electric Co.	1597 East 31st Street Cleveland, Ohio
COC	Oak Manufacturing Co.	1200 N. Claybourne Avenue Chicago, Illinois
CRK	Radio Condenser Co.	Camden, N.J.
	Whitso, Inc.	9330 Byron Street Schiller Park, Illinois

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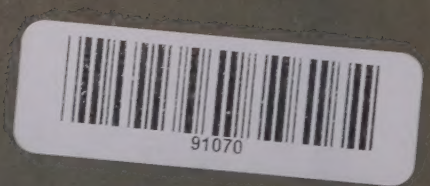
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